PMM

MAY
1955

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

devoted exclusively to:

DIE CASTINGS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

"We converted a stamped assembly to this 56-inch aluminum permanent mold casting for the Lincoln convertible . . ."
Louis M. Spiess, Director of Purchases & Production Control, Motor State Products Div., Detroit Harvester Co.

See Page 26

Aluminum or Zinc Alloys

that always help you get better quality castings and trouble-free production

Aluminum ALLOYS

- All ingot produced for die casting, permanent mold and sand casting requirements have superior working characteristics and are free from impurities and gas.
- Composition is constantly checked during production to assure ingot meets your specifications.
- Orders are promptly processed and shipped with certificate of analysis.
- Shipments are palletized for fast, efficient handling.

ZINC BASE DIE CASTING ALLOYS Zamak

- All ingot is quality controlled during production to insure uniform quality metal.
- All alloys to your specifications.
- All shipments are palletized and shipped with a certificate of analysis.
- Deliveries are promptly made to meet your production schedule.

Aluminum Smelting & Refining Co., Inc.

BEDFORD, OHIO
TELEPHONE: CLEVELAND MOntrose 2-3100

INDIANAPOLIS, INDIANA
215 Circle tower • PHONE: MElrose 8-5541

DETROIT, MICHIGAN
P. O. BOX 4014 • PHONE: VErmont 7-9962

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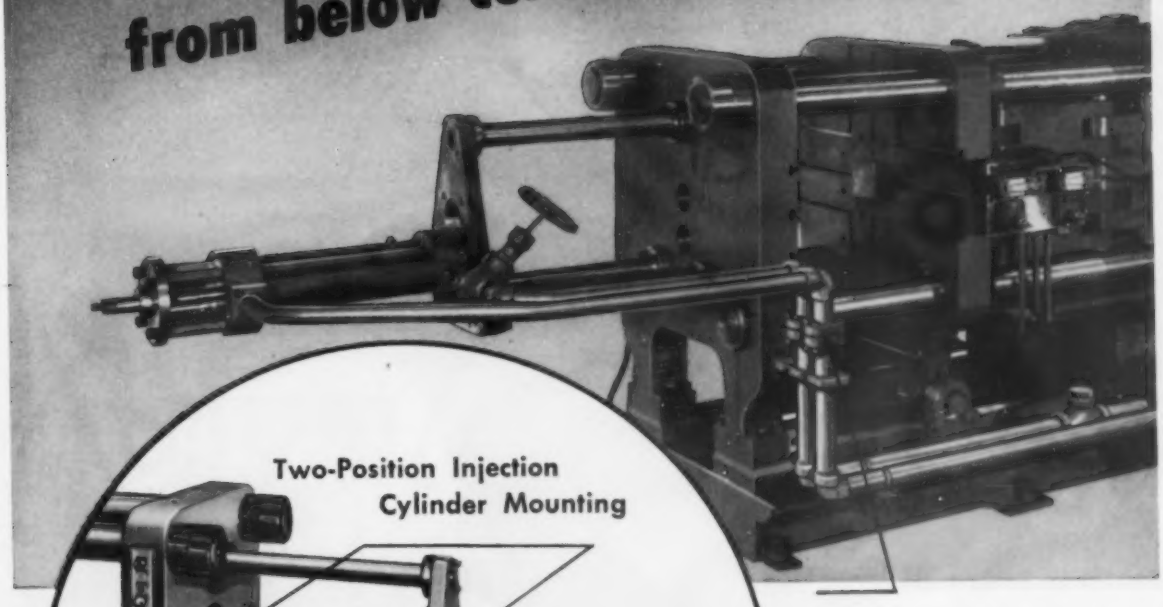
Another CAST-MASTER BONUS feature

FAST, EFFICIENT CHANGE-OVER from below center to center shot!



When changing from below center to center shot, simple addition of extra section of pipe eliminates the use of hose or flexible tubing, thereby affording an extra measure of safety.

Two-Position Injection Cylinder Mounting

Spacer block in plunger rod permits penetrations up to 8" in cover half of die . . . plunger stroke adjustment is built into head, allowing plunger to be retracted far enough to uncover metal well.

In modern production, time means money. That's why leading die casters praise the exclusive features shown here, which permit rapid change-over without sacrificing safety. To learn about other Cast-Master "bonus" features, send for the new, complete catalog giving illustrations and specifications on eight great new models.

SEND FOR CATALOG!

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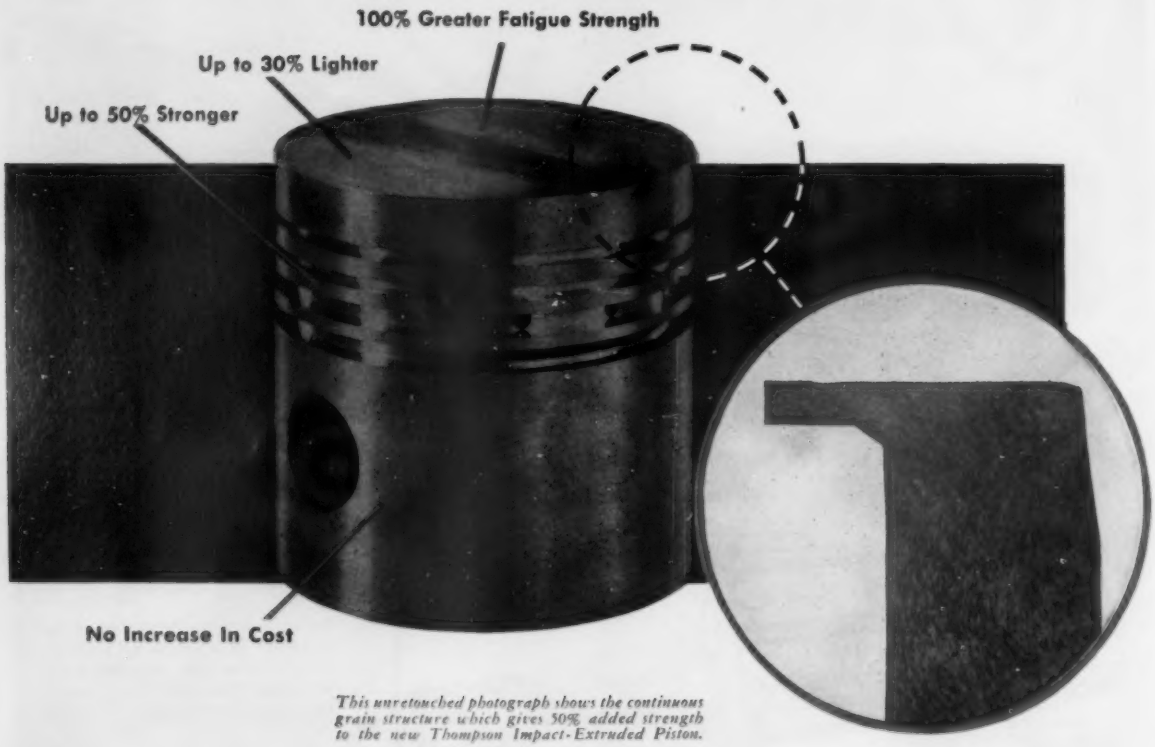
THOMPSON PRODUCTS ANNOUNCES A NEW IMPACT-EXTRUDED PISTON



This unretouched photograph shows the continuous grain structure which gives 50% added strength to the new Thompson Impact-Extruded Piston.

THE all-new Thompson Impact-Extruded Piston is the first lightweight piston especially designed and engineered for all automotive engines. This new piston will soon be available to manufacturers of piston engines.

Made by an impact-extrusion method, this new piston is heat treated for higher tensile strength, greater ductility and 100% increase in fatigue life.

For over 50 years Thompson Products has been designing and precision manufacturing automotive parts to the closest tolerances known to the industry. Constant metallurgical research and experimentation join with this design and manufacturing to bring this new, lighter, stronger piston to the automotive builder at no increase in cost.

For complete information on this newest Thompson development, write, wire or phone Light Metals Division, Dept. PM-2, Thompson Products, Inc., 2269 Ashland Rd., Cleveland 3, Ohio.

You can count on

Thompson Products

LIGHT METALS DIVISION
2269 Ashland Road • Cleveland 3, Ohio

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pmm

May 1955

Volume 13 Number 5

precision metal molding

DIE CASTINGS
INVESTMENT CASTINGS
PLASTIC MOLD CASTINGS
PERMANENT MOLD CASTINGS
POWDER METALLURGY
SHELL MOLD CASTINGS

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FEATURE ARTICLES

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26 **BIG CASTINGS CAN BE PRACTICAL,** new massive permanent mold machine permits castings up to 100 pounds.

29 **SOLVED: AN OIL SEEPAGE PROBLEM.** How a change in castings cures a porosity condition.

30 **ONE-PIECE STEEL MOTOR MOUNT RESISTS SEVERE VIBRATION.** Investment casting improves performance and cuts cost.

32 **WHAT GOES INTO THE COST OF A POWDERED METAL PART:** a summary for buyers, pointing out influence of quantity, size and shape of parts.

34 **FOR YOUR LARGE, THIN-WALLED COMPONENTS** you should consider frozen mercury investment castings.

36 **IN PRECISION INSTRUMENTS . . . MORE DIE CASTINGS.** Both zinc and brass die castings go into this surveyor's transit.

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FINISHING SECTION

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A reliable source for die casting requirements

AMERICAN ZINC SALES COMPANY

Distributors for

American Zinc, Lead & Smelting Company

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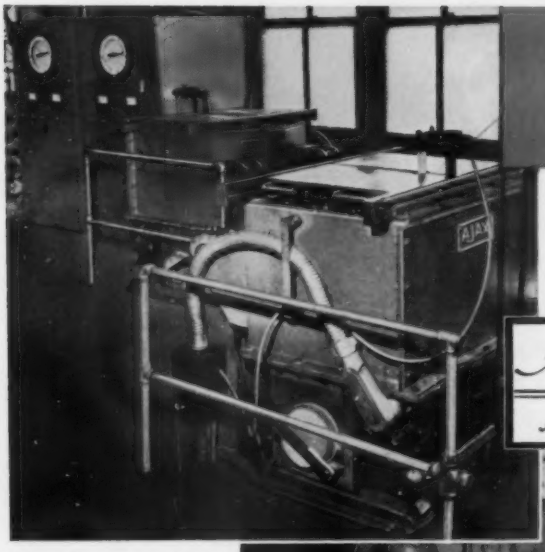
AJAX INDUCTION FURNACES

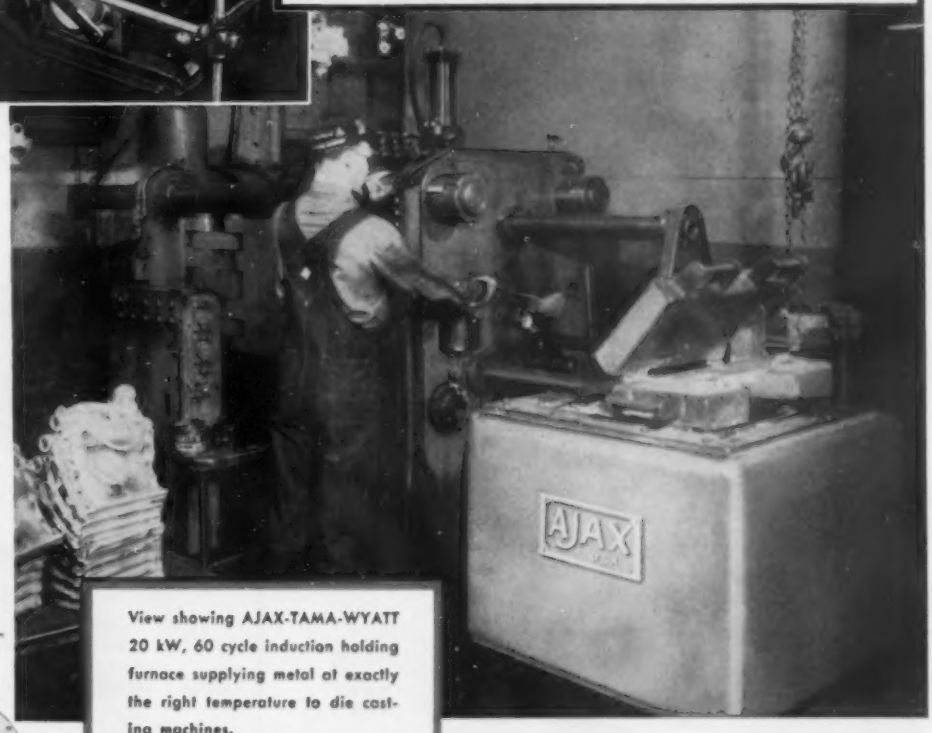
mean Higher Quality Castings for...

Advance
TOOL & DIE CASTING COMPANY

Aluminum DIE CASTINGS *Zinc Base*



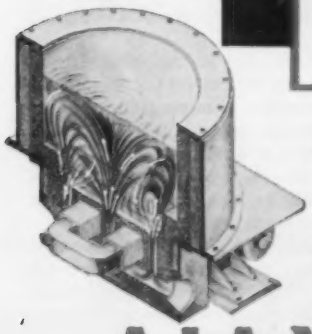
View above shows AJAX melting furnaces, with control cabinets in background.



View showing AJAX-TAMA-WYATT 20 kW, 60 cycle induction holding furnace supplying metal at exactly the right temperature to die casting machines.

The Furnace That Stirs Itself...

The sectional view below shows the twin-coil stirring action of the 100 kW, 60 cycle AJAX Induction Furnace. Heat induced in the secondary channels below is conveyed throughout the melt by electro-magnetic circulation, as shown by the arrows.



Inherent stirring action of these furnaces has proved most valuable to ADVANCE TOOL & DIE CASTING CO., Milwaukee, Wisc. In full operation for 18 months, the most important result of the use of these furnaces is higher quality die cast aluminum parts. The alloy is held in uniform solution, resulting in elimination of oxides, reducing hard spot trouble in secondary machining to a negligible factor. Temperature of the melt is held at 1170° F. through on-off control of the low power circuit. Working conditions are made more comfortable because of low heat losses. The units take up very little floor space.

AJAX TAMA-WYATT

AJAX ENGINEERING CORP., TRENTON 7, N. J.

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High-Frequency Induction Furnaces
AJAX ELECTRIC CO., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

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This alloy list keeps getting longer and longer!

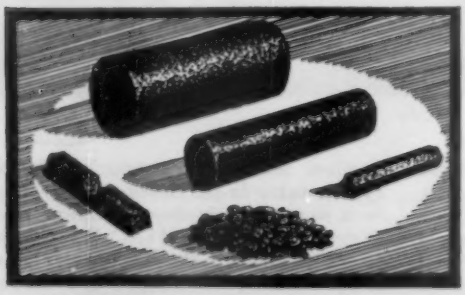
Cannon-Muskegon can supply scores of special and standard alloys for remelt or reprocessing, certified to your exact specifications

*NI RESIST
SAE 1020
SAE 4130
SAE 52100
SAE 6150
SAE 8630
AMS 5382B
AMS 5385B
AMS 5388
PWA 651
ARMCO 17-4-PH
4750
AISI 300 SERIES
AISI 400 SERIES
*MONEL
*INCONEL
ACI-H7
18-4-1
IIB2
IID2
INVAR
CO-CR-W ALLOYS
CU-NI ALLOYS
NI-CR ALLOYS
NI-FE ALLOYS
NI-CR-FE ALLOYS
CR-FE ALLOYS

*©International Nickel Co.

A *long* alloy list is an excellent indication of long alloy experience! As source for many of the nation's major investment casting suppliers and others, Cannon-Muskegon furnishes a great variety of alloys for remelt or reprocessing. Alloys include super stainless and tool steels, as well as nickel and cobalt-base alloys. Other alloys are prepared specially for medical, aeronautical, electronic, industrial and experimental uses.

These alloys are in addition to a wide range of carbon and 300 and 400 series stainless steels regularly carried in stock for *immediate* delivery. Remember . . . no matter what type alloy you specify each is backed with a notarized metal analysis insuring *exactly predictable* physical, chemical and electrical properties.



MASTERMET ALLOYS are available in either ingot, shot, hexagon bar, billet or 12"-long, 6" diameter cast round bar form. Alloys are shipped in drums with specifications clearly imprinted for fast selection and storage.

WRITE for your copy of New MasterMet Bulletin and technical data on the complete MasterMet alloy service.

Cannon-Muskegon
CORPORATION
2871 Lincoln Street • Muskegon, Michigan

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METALLURGICAL SPECIALISTS

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LETTERS TO THE EDITOR

ABBREVIATION?

The article by Mr. Roberto Levi in the March 1955 issue of Precision Metal Molding on a "New Method for Machining Sintered Tungsten" is very interesting.

He uses a term in connection with sintering temperatures which I have never seen before, namely: 1100°C Br, 2400°C Br, etc. The term Br should be clarified.

All handbooks we have, even the International Critical Tables, do not show °C Br. We do find °F, °C, °K, °R and °T. Please explain. — H.H.L. (Chief Metallurgist)

We have checked with Mr. Levi who says "As for the term Br used in connection with sintering temperatures in my article, kindly note that it is an abbreviation for 'brightness', implying that the temperature measurements were taken with an optical pyrometer and that no corrections were made for emissivity."—Ed.

AUTOMATIC MASK PAINTING

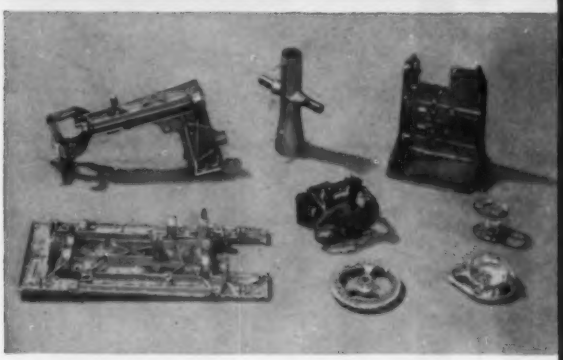
In the April 1955 issue of your magazine there was an article on page 65 written by a Mr. Harry Szczepanski with regard to "Automatic Spray Mask Painting".

In that the management of this company is interested in such a process and obtaining more information on the equipment for performing this operation, we would like to enlist your aid in obtaining the address of Sepanski and Associates.

With this information we will be able to get in direct contact with this organization and obtain the information that we desire.— J. A. U. (Buyer)

This article on ways to step up production in selective painting of die castings by means of automatic spraying, masking, washing, etc., has had much interest. Address and information have been forwarded.—Ed.

You Can LOWER COSTS with PRECISION DIE CASTINGS

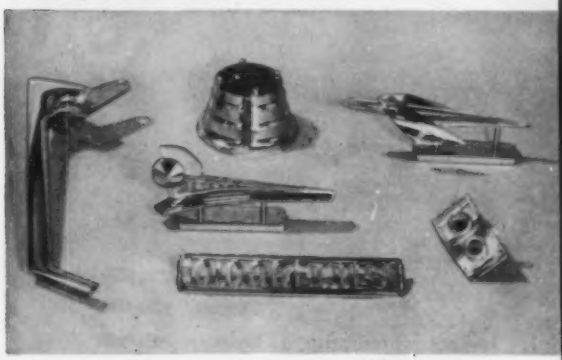


COMBINE PARTS INTO ONE DIE CASTING

Substantial savings in production costs can often be realized by combining several parts into one Precision die casting. You save not only on the cost of the parts but also assembly costs are eliminated.

REDESIGN PARTS FOR MORE ECONOMY

Parts formerly produced by other methods can be redesigned for low-cost die casting. Even present die castings may be redesigned for more economical production.



FINISHING COSTS ARE LOW

Precision die castings can be painted, oxidized, plated or self-finished by polishing. Precision has complete facilities for finishing die castings.

DIE CASTINGS FOR FUNCTIONAL PARTS

More and more functional parts are now being die cast at great savings. Today's modern alloys plus Precision's design and engineering skills combine to produce rigid, strong, accurate functional die castings.

Call a PRECISION Engineer, Today!

*Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry

PRECISION CASTINGS CO., Inc.
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Syracuse, N. Y. · Cleveland, O. · Chicago, Ill.
Kalamazoo, Mich. · Cortland, N. Y.
British Affiliation — Wolverhampton Die Casting Co., Wolverhampton, England

For more information circle No. 73 on the Reader Service Card

The Symbol of Quality Zinc Die Castings And Superior Service

24 years of producing Zinc Die Castings exclusively for industry

The Schultz trademark is a symbol representing a 24-year reputation for expert craftsmanship, reliability, and integrity. It is your assurance that each casting is produced under strict metallurgical control to meet exacting specifications.

Our years of experience, our trained personnel, and our complete modern production facilities are always at your service. Let us show you how we can help you.

- means expert design engineering
- means high quality zinc die castings at competitive prices
- means fast deliveries
- means fast price quotations

SCHULTZ DIE CASTING COMPANY

1810 CLINTON STREET • TOLEDO 7, OHIO

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ACCUMET PRECISION INVESTMENT CASTINGS

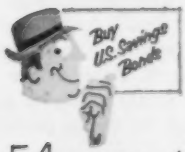
are available in all steel and high-alloy grades...

Here are some of the more popular grades used for Crucible ACCUMET precision castings
AISI 1010 — Magnetic Iron
AISI 1020 — Low Tensile
AISI 4620 — Carburizing
Mod. 4140 — Medium to High Tensile
Ketos Oil-Hardening Tool Steel
HYCC Air-Hardening Tool Steel
Rezistal 410 — Hardenable Stainless
Rezistal 303 — Free Machining Stainless
Rezistal VT — AMS 5385B High Temperature
Rexalloy — Cr-W-Co Alloy
Alnico Magnets

Whatever the grade of steel or high-alloys your specifications call for, you can get it in Crucible ACCUMET® precision castings.

And you can depend on the quality of ACCUMET castings, for they are made by the Country's leading specialty steel producer . . . to long established steelmaker's melting standards, in modern electric furnaces. The composition of ACCUMET is carefully controlled by chemical analysis of the *casting* — not merely of the remelt stock charged into the furnace. This extra control of analysis means better uniformity in response to heat treatment, hardenability and performance.

Put an end to costly machining of parts. Let your Crucible representative show you how ACCUMET precision investment castings can save you time and money.



54 years of *Fine* steelmaking

CRUCIBLE first name in special purpose steels

ACCUMET PRECISION CASTINGS

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REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MAX-EL • SPECIAL PURPOSE STEELS

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We have no time...

at Belmont!

Once your order is in – OUR TIME IS YOURS. For here at Belmont every order is "rush" ...goes right into production for earliest possible delivery. A full crew stands ready at all times to serve you.

Now, with expanded facilities and up-to-the-minute equipment, the Belmont team will supply the usual Belmont quality–faster than ever before!

Don't specify "rush" – specify "Belmont"!

Belmont

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"Putting Mettle into Metals Since 1896"

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BETWEEN THE LINES

WHAT MAKES COST? Too often the price quotations on a certain piece may vary so widely that the buyer wonders whether all bidders are talking about the same job. Sometimes there are good reasons for this variation, other times it may mean that someone has overlooked an important element in setting up his cost estimates. Just what has to be considered in setting prices? In this issue, a manufacturer of powdered metal parts outlines for buyers all the factors that must be considered in arriving at a sound quotation. PMM presents it beginning on page 32 as a help to buyers.

BEAUTIFUL IS AS BEAUTIFUL DOES. We are so accustomed to thinking of die castings in terms of the decorative trim on our cars, that we fail to note some of the places die castings are used for heavy-duty structural parts or where extreme precision is needed. Two such examples appear in this issue: on page 25 is a use of die castings for industrial machinery components, and on page 36, die castings in a surveyor's transit.

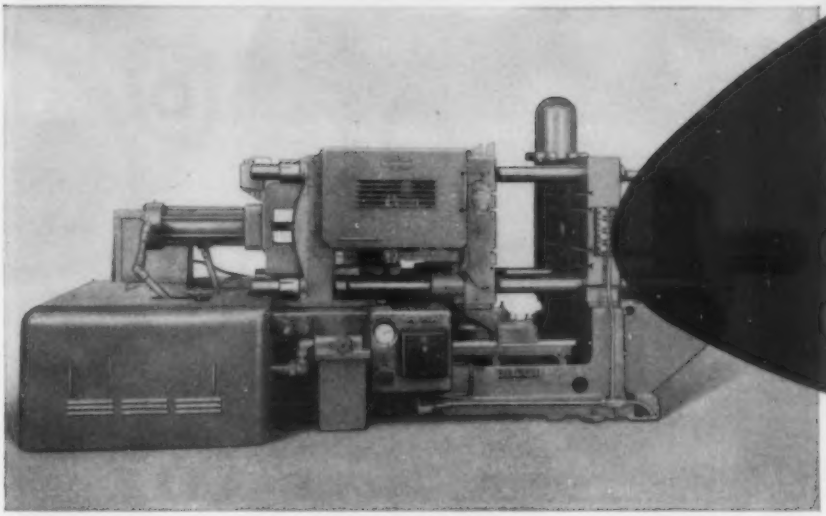
A 17-LB. CASTING WITH .100 WALLS. If this sounds "special" to you, you're right, but there is a good and practical way to make such a piece. An article beginning on page 34 reports on the use of frozen mercury investment castings to get extra large pieces with thin wall sections. A unique feature of the frozen mercury process makes this possible.

DIRECT CHROMIUM OVER ZINC is a practical method of electroplating zinc die castings, as one manufacturer of liquid soap dispensers has found in his own shop. His plating cycle for applying direct chromium is reported on page 53.

YOUR GUIDE to sources for anything connected with powder metallurgy is the main feature of this issue. We are proud of our Fourth Annual Powder Metallurgy Directory which starts on page 85. You'll find that data sheets tabulating physical properties of metal powders and metal powder compacts. Also, there are listings of sources for powdered metal parts, for powder metallurgical equipment and for metal powders.

PRO'S AND CON'S of several different methods for mounting ejector pins in a die casting die are discussed by a British die casting specialist, beginning on page 45.

REED-PRENTICE
DIE CASTING MACHINES



CONTROL... to speed production

Simplified controls for steady, high-output production

Your machine operator will turn out consistent, high-level production on a REED-PRENTICE Die Casting Machine. These machines are designed for easy, safe operational control. Here are some of their features:

1. Central operator's station controls movement of die, plunger and cores. Equipped with easy-to-operate lever-type push-buttons
2. Convenient foot switch controls ejection plunger on cold chamber machines
3. Automatic electric timers control machine cycle
4. Lever on control station actuates core pulling cylinders when they are used
5. Machines may be set for manual or semi-automatic operation

free

Write for your free copy of booklet describing these and many other features of REED-PRENTICE Die Casting Machines

REED-PRENTICE CORP.

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Affiliate of **PACKAGE MACHINERY COMPANY**

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STRIPPING ENAMEL . . .

SAVING TIME

*Enthonics** AT WORK

25 seconds from immersion to completed stripping!

That's the fast, dramatic story of ENTHONE Enamel Stripper S-18 in action — another example of *Enthonics at work.**

Enthone Enamel Stripper S-18 is the modern organic stripper developed for removing the newest organic finishes such as Epon or Epoxy coatings and many synthetic enamels from copper, copper alloys, steel and aluminum.

For the right strippers to solve your organic stripping problems fill out a questionnaire we'll send at your request; return it with typical samples of your work. Enthonics will find the answer . . . without obligation!

And ask for your copy of the "Enthone Check List" of literature covering more than 60 products and processes developed for modern electroplating and metal finishing.

* *The Scientific Solution of Metal Finishing Problems*

ENTHONE INCORPORATED

METAL FINISHING PROCESSES

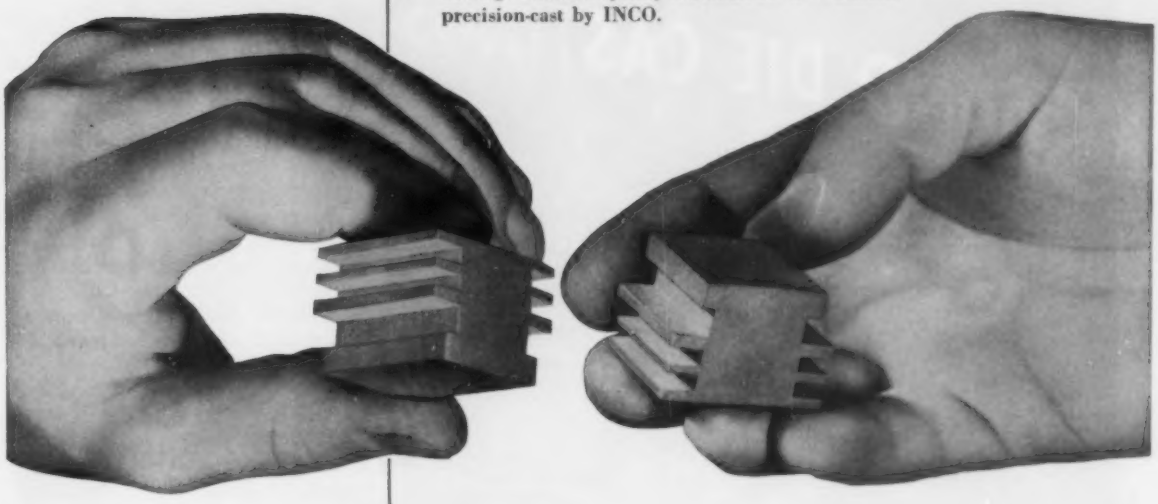
442 ELM STREET, NEW HAVEN 11, CONNECTICUT

ELECTROPLATING CHEMICALS

Service Representatives and Stock Points: BINGHAMTON, N. Y., Austin F. Fletcher, Inc.; CHICAGO, Ardco, Inc.; CLEVELAND, R. O. Hull & Co.; DALLAS, Weaver Engineering & Supply Co., Inc.; LOS ANGELES, L. H. Butcher Co.

For more information circle No. 29 on the Reader Service Card

In the Navy's 70-million candlepower searchlights these two parts hold the carbon electrodes and feed the heavy current into them. They also have to withstand the heat radiated by the arc to maintain good electrical contact without oxidizing or scaling. That is why they are made of "D"® Nickel, precision-cast by INCO.



Which part takes 20% less machining?

The question is loaded. The answer is both!

Both parts are precision investment cast by Inco, and require 20 per cent less machining than previously, when they were sand cast.

In fact, those fins you see at either side need no machining at all.

These particular parts happen to be carbon electrode holders for Navy searchlights. But the same savings go for many small parts that require close tolerances. Inco precision casting reduces machining operations and machining time. Saves material ordinarily machined away. *Cuts costs!*

To give you just a few examples, Inco precision casting reduced machining on a part for a bottle capping device 75%; cut cost of a collet head for a liquor dispensing system 30%; cut cost on a gas-lift valve cam 84%.

Where can you cut costs with INCO Precision Casting?

Wherever you have a part which is 6 inches x 5 inches or smaller, weighs under 3 lbs., requires starting tolerances as close as plus or minus .005 inch per linear inch, and needs 5 or more fabrication steps, there's a good chance you can save by having it precision cast.

INCO precision casts most high-melting point alloys from carbon steel to the new super alloys.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

5 Advantages of INCO Precision Castings

- Save up to 60% of production costs.
- Longer life with harder alloys.
- Little or no machining required.
- Wider design latitude.
- Higher alloys at lower cost.

Get This Helpful New Booklet

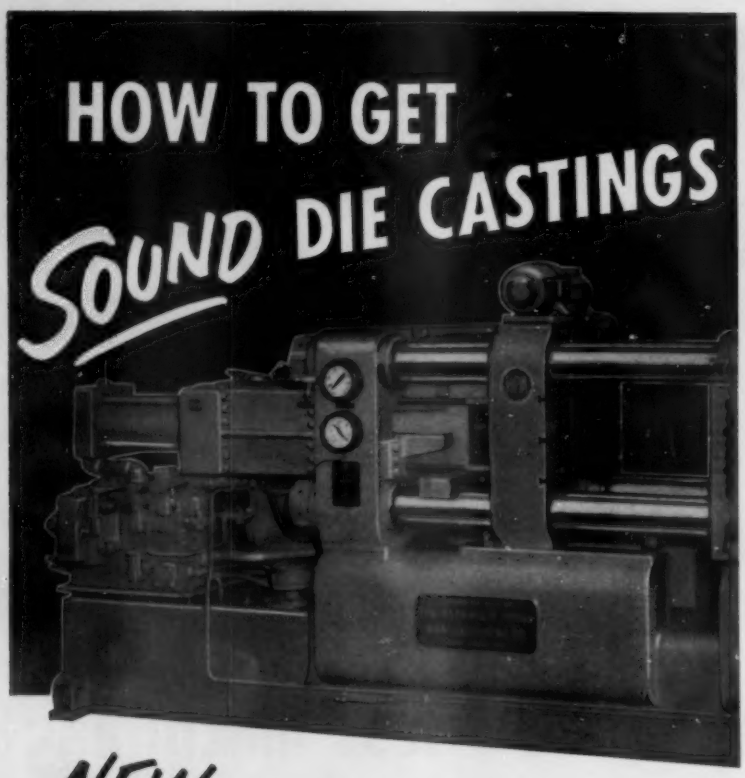
Trying to keep costs in line on some small part? Then write for new 16-page booklet, "Cast to Outlast." Contains many case histories detailing how others cut costs with Inco precision castings. There is a good chance this helpful data will suggest a practical way to cut your costs, too.

INCO TRADE MARK

Inco Castings

Precision, Sand, Centrifugal

For more information circle No. 44 on the Reader Service Card

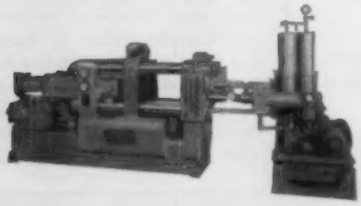


NEW H-P-M Mechanical Clamp Assures Positive Die Locking

Here's why H-P-M's new die casting machine makes better castings: new positive clamping action is achieved by sliding wedges driven by knuckle-joint linkage which preloads the press frame and backs up the platen. The results . . . a minimum of flash . . . sound castings.

In this new H-P-M clamp mechanism there are no toggle pins under heavy shear load . . . no single line contacts . . . and no extremely high stressed members that normally result in high maintenance cost and down time.

These are just a few of the 40 new and improved features of the new H-P-M die casting machine. Write for Bulletin 5400, a completely illustrated story on this H-P-M line of profit makers.



THE HYDRAULIC PRESS MANUFACTURING COMPANY

1094 Marion Road
MOUNT GILEAD, OHIO, U.S.A.

HPM

For more information circle No. 42 on the Reader Service Card

Atwood Fuller has been appointed sales engineer in the Chicago area for *Baldwin-Lima-Hamilton Corp.* and **Robert Neilson** as specialist in metal forming and drawing.

Harry E. Ladwig has been named foundry consultant for *Allis-Chalmers Mfg. Co.*

Oliver A. Gottschalk is now assistant to the president of *The Carborundum Co.*

Vern L. Ripley has been appointed contracting representative for the southern New York state and central eastern section for *Designers for Industry.*

Gordon R. Porterfield has been appointed as district representative in New York for *Elmes Engineering Div. of American Steel Foundries.*

Two new appointments have been announced by the *Carboloy Div. of General Electric Co.* **R. J. Studders** is now manager of magnetic products engineering and **John A. Clements** is supervisor of manufacturing methods and time standards.

P. J. Slavish now handles the sales of hydraulic presses in western Pennsylvania and West Virginia for *Baldwin-Lima-Hamilton Corp.*

Richard A. Biggs was appointed manager, product development, *Stainless Div. of Crucible Steel Co. of America.*

Harold R. Foss has been appointed director of the manufacturing engineering office of *Ford Motor Co.*

Myron T. Bennett has been named promotional manager of the *Metal Industries Dept., The Diversey Corp.*

William H. Ross has been named vice president of sales for three associated companies, *Bart-Messing Corp., Sel-Rex Precious Metals, Inc.* and *Detroit Die Casting Corp.*

Jerome B. Wallaston has joined the staff of *Inductotherm Corp.* as director of sales and service.

the telling touch

"Slik" toys manufactured by Lansing Co., Inc., Lansing, Iowa

in designing with MADISON-KIPP zinc and aluminum die castings

THE ELUSIVE FACTOR that finalizes a sale quickly is the greatest concern of the designers of toys and other products for the mass market.

Of course, there must be play value in toys and use value or other attractions to all counter merchandise, but *the telling touch* that increases sales is often the eye appeal and the instantly recognizable high quality provided by Madison-Kipp die castings.

Madison-Kipp personnel excel in the art of thin-section die castings so essential in toys and many other products where lightness and strength are prime requirements.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

- Skilled in Die Casting Mechanics
- Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools

For more information circle No. 52 on the Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

To get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

3. DRY FILM LUBRICANTS that reduce rejects, increase mold life, and decrease die lubricant consumption are described in reprint DC and Bulletin No. 426-V10 from Acheson Colloids Co. describing these graphite and molybdenum disulfide products and their uses.

6. POWDERED METAL SPEC. SHEETS: A group of data sheets are available giving the physical characteristics and properties of the powdered metals supplied by American Metal Co., Ltd.

10. STEEL PARTS BY POWDER METALLURGY: The Amplex Div. of Chrysler Corp. has available a comprehensive book on Steel Oilite. Given are the properties of the material and many suggested uses.

15. INVESTMENT CASTING ALLOYS: A wide range of carbon and alloy steels suitable for investment casting are listed with their chemistry and as-cast physical and mechanical properties in the new MasterMet bulletin from Cannon-Muskegon.

16. MOVABLE INJECTION CLYINDER: One of the features of the CastMaster die casting machines is the rapid change-over from center to below mounting of the injection cylinder. All of the advantages and characteristics of these machines are given in the new catalog.

18. CUT MANUFACTURING COST: The use of parts made from metal powders is discussed in literature that has been published by the Chicago Powdered Metal Products Co.

19. DIE CASTING MACHINES: A line of improved die casting machines that are said to produce castings with a hardware finish and with virtually no scrap losses is described in bulletin 400 that has been issued by The Cleveland Automatic Machine Co.

22. FORGED EJECTOR PINS: How the use of forged, solid head ejector pins can reduce machine down-time due to pin breakage and cut initial die costs are told in the 8 page ejector pin data file from Detroit Mold Engineering Co.

23. ADVANTAGES OF POWDER METALLURGY: In a new booklet entitled "Advanced Powder Metallurgy," Dixon Sintaloy, Inc. has written about powder metallurgy and its advantages as a manufacturing method.

25. SINTERING & REDUCING FURNACES: A new bulletin, No. 101, has been prepared by the Drever Co. describing some of the many sintering and oxide reduction furnaces that the company builds. Included is a discussion of sintering of powdered metal parts.

26. IRON POWDERS: Iron powders for a wide variety of applications are described in data sheets prepared on RZ iron powders by the Easton Metal Powder Co., Inc.

29. ENAMEL STRIPPING: Stripping enamel from metal parts such as aluminum, copper alloys and steel is made highly economical with the new S-18 stripper. This is only one of the 50 Enthone products and processes for modern metal finishing. A check list of literature on these processes and products is available.

30. VACUUM CASTING: A vacuum casting process for the production of investment castings of superior quality has been developed by Engineered Precision Casting Co. Literature on the new process is available.

33. ALUMINUM-FORMING LUBRICANTS: Special lubricants for use in working aluminum have been developed by Fiske Bros. Refining Co. Each different process should use a special lubricant for the work. Technical data on the different lubricants have been prepared.

35. IMPROVED METAL POWDERS: The Glidden Co. has technical data on its "Resistox" metal powders and metal oxide powders. The improved surface is said to give better performance.

36. TINY ZINC DIE CASTINGS: The Gries Reproducer Corp. has issued an informative booklet on the small zinc die castings they can make.

39. THE HENNING MESSENGER: This house organ of Henning Bros. & Smith, Inc. contains information on zinc alloys, zinc base die castings and news of the plant.

41. "DIE CASTINGS BY HOOVER:" This booklet, published by the Hoover Co., gives much valuable information for the designer, user and potential user of die castings.

42. IMPROVED DIE CASTING MACHINES: A new bulletin, No. 5400, has been published by the Hydraulic Press Mfg. Co. which describes many of the improvements that have been built into their line of high pressure die casting machines.

44. DESIGNING INVESTMENT CASTINGS: A new booklet, "Cast to Outlast" has been published by The International Nickel Co. giving design information and mechanical properties of investment castings.

45. TRIMMING & PUNCH PRESSES: Bulletin 1955, from Johnson Machine & Press Corp. gives size specifications and operational information of the complete line of presses.

46. KEYSTONE POWDER METALLURGY: A new booklet has been published by the Keystone Carbon Co. that tells what can and cannot be made in metal powders. Properties of compacts and some design information are included.

47. ROCKING ARC FURNACES: Complete information and operational data on rocking type arc furnaces for small and medium-sized melts are contained in a new booklet from Detroit Electric Furnace Div. of Kuhlman Electric Co.

49. INCREASED MACHINE OUTPUT: The Lake Erie Engineering Corp.'s new die casting machines feature improvements that are said to increase production 15 to 25 percent, described in Bulletin 23.2.

50. SINTERING FURNACES: A complete line of sintering furnaces and atmosphere generators is described in the Lindberg Engineering Co. bulletin 230. The bulletin also gives much valuable data on powder metallurgy.

51. DESIGNING DIE CASTINGS: A booklet that has been prepared by Litemetal Dicast, Inc. contains information on the proper design of die castings in aluminum and magnesium.

57. INFINITE SHOT CYLINDER ADJUSTMENT: One of the features of the new 600-ton Midwest die casting machine is the infinite adjustment (within 6 inches) of the shot cylinder. A bulletin describes this and other features of the machine.

59. INVESTMENT BINDERS: Complete specifications on both 40 percent and 28 percent, water white ethyl silicate are available from R. W. Greeff & Co., Inc.

63. COST CUTTING WITH POWDER METALLURGY: A new booklet published by National Molded Products Co. shows how to cut costs through

Continued on page 18

Partial view of the aluminum die cast department of the Tri-State Die Casting Co., showing Cleveland Model 400's producing the Servel Automatic Ice Making Unit.

Servel "IceCircles" take shape...

in CLEVELAND die casting machines at Tri-State Die Casting Co.

The ice-making unit, the aluminum casting shown at left, for the unique Servel Automatic Ice-Maker Refrigerator, is produced by the Tri-State Die Casting Co., Henderson, Ky., in a battery of Cleveland Model 400 Die Casting Machines.

The high metal injection pressure obtainable with the Cleveland Model 400 assures a sound, dense casting, free of all porosity and surface defects . . . highly important in this aluminum casting as any slight imperfection could cause difficulty in dislodging the ice from the mold. "*Scrap on this job is practically nil*" is the report from Tri-State, indicating the high quality of the *hardware finish* castings delivered by the Cleveland machines.

This is another example of how the nation's leading die casters rely on Cleveland dependable performance. To get the most from *your* die casting department—in speed of production and quality of casting—investigate the advantages of the Model 400 Cleveland. Bulletin 400 gives you complete information. Write for your copy.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

For more information circle No. 19 on the Reader Service Card

DATA IN ADS
continued from page 16

the use of powder metallurgy. Included is a listing of standard sized bushings carried in stock.

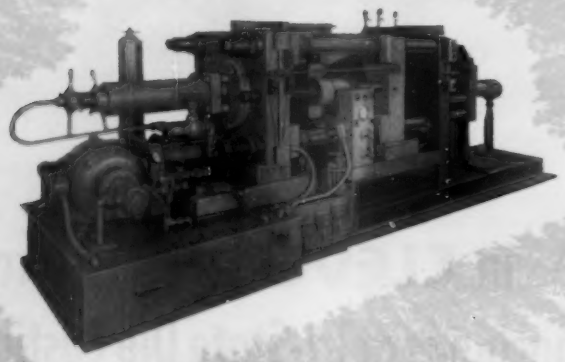
66. PRESSED BRASS POWDER: The advantages of molding parts from brass powder are fully discussed in a booklet from New Jersey Zinc Co. Case histories, design information, and physical properties are included.

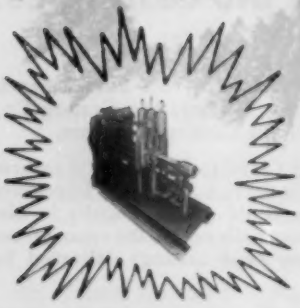
67. PRECISION BY PLASTER MOLDING: How the plaster mold casting process can save money by eliminating machining is told in a brochure from Ohio Precision Castings, Inc.

68. DIE CASTINGS BY PARAMOUNT: Illustrations of some of the die castings made by Paramount Die Casting Co. and their facilities are shown in a new brochure.

71. WAXES FOR INVESTMENT PATTERNS: Waxes and parting agents for the investment casting industry are discussed and their complete properties given in data sheets from the Petrolite Corp.

NEW! 600 TON
DIE CASTING MACHINE
featuring INFINITE ADJUSTMENT





WHY BE LIMITED! Midwest-Foster — Newly designed JET-SPEED — HI-PRESSURE injection end permits infinite adjustment of shot cylinder — easily and quickly up to 6 inches below center.

Revolutionary features include heavy framing and platens, fast clamping action, maximum injection speeds and pressures, hydraulic and electric interlock safety factors, minimum maintenance, all of which contribute to bigger profits for you.

Injection assembly permits safe, efficient ladling of metal. Adjustment of jack screw and 2 gland nuts simplify positioning of shot cylinder. No additional piping or flexible tubing required.

Write for free detailed bulletin and specifications, fully illustrated.

Midwest MACHINE CO., INC.
Manufacturers of Midwest-Foster Die Casting Machines
2826-28 W. Walnut St. • Chicago 12, Illinois

For more information circle No. 57 on the Reader Service Card

72. PARTS FROM METAL POWDERS: The Powdercraft Corp. has available a brochure that gives pertinent data on powder metal parts.

76. IMPROVED DIE CASTING MACHINES: The many improvements and innovations that are incorporated in their die casting machines are described in a booklet from the Reed-Prentice Corp.

77. HIGH DENSITY CASTINGS: The metallurgical department of the George Sall Metals Co. offers a booklet on the production of leakproof aluminum castings.

81. "POWDER METALLURGY TODAY:" one of three booklets available from the F. J. Stokes Machine Co. on powder metallurgy and equipment for making powdered metal parts.

84. SPECIAL SILICAS: Special, high purity silicas for investment casting are described and prices given by Tamms Industries, Inc.

85. IMPACT EXTRUSIONS: Automotive pistons formed by impact extrusion are one of the latest developments of Thompson Products, Inc. Full information is available.

86. COMPLETE MANUFACTURING: From the raw die casting to the finished and assembled product is the complete service offered by Tri-State Die Casting Corp.

89. POWDER METALLURGY ADVANTAGES: The savings in costs and the improved performance made possible through the use of powder metal parts are fully explained in a booklet from Yale & Towne Mfg. Co., Powder Metal Products Div.

90. BURNISHING MATERIALS: Selecting the proper media and the right shape for your particular barrel finishing job is the subject of a booklet issued by The Abbott Ball Co.

92. BARREL FINISHING: How to cut finishing costs and do a better job is described in the new Almco Supersheen catalog.

93. TUMBLE FINISHING: A complete catalog is now available on the newly designed barrels made by Grav-I-Flo. They are said to turn out 25% more volume in 30% less floor space.

95. BARREL FINISHING: The facts and figures about barrel finishing using the Honite method are given in a booklet published by Minnesota Mining & Mfg. Co.

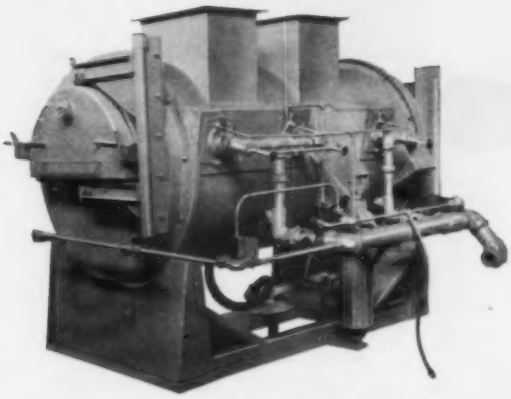
97. SPIN-DRYING: A new 4 page bulletin published by the New Holland Machine Co. describes the spin-drying of small parts.

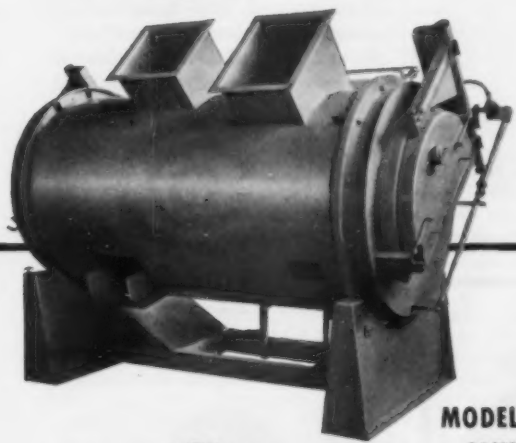
98. METAL CLEANING: Oakite Products, Inc. has issued a new booklet on metal cleaning. All metals and all types of cleaners are covered with recommendations for each case.

101. AUTOMATIC FINISHING: The Roto-Finish method of parts finishing does a smooth, fast, economical job with no significant dimensional change. A catalog tells about the process and the equipment used.

For more information circle No. 82 on the Reader Service Card →

Another Stroman 1st

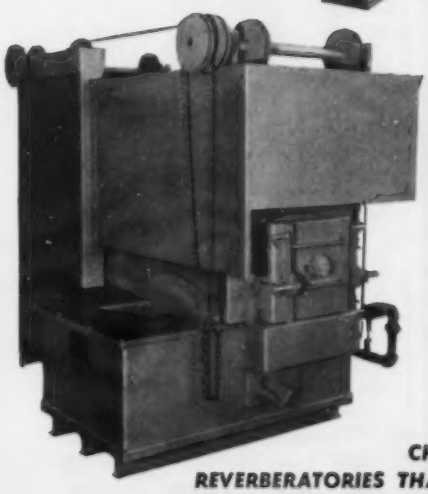




THE FAMOUS MODEL "DC" ALUMINUM
REVERBERATORY FURNACE NOW AVAILABLE WITH...

Pneumatic Tilt Operation

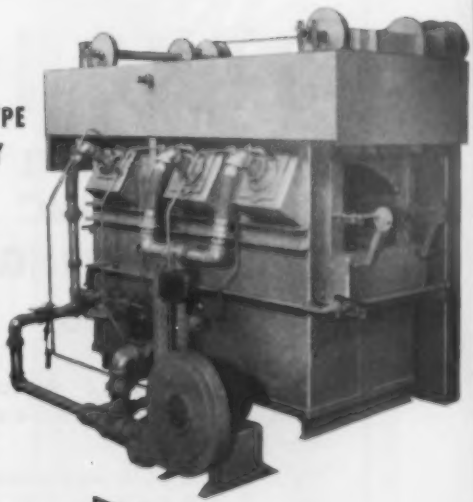
Stroman again sets the pace in the aluminum melting field with their new TILTING TYPE "DC" REVERBERATORY FURNACE for Die Casting, Sand Casting and Permanent Mold plants. Built to specifications that assure perfect metal on every pour, they melt faster, keep metal flowing when you want it . . . are most economical to operate and maintain . . . and assure castings of only the finest quality, which means a minimum of costly rejects. Truly they are the furnaces that can handle any capacity you desire and have metal at correct casting temperature, ready for pouring at all times. Investigate their possibilities in your plant to-day.



STROMAN

MODEL "DC" STATIONARY TYPE ALUMINUM REVERBERATORY MELTING FURNACE

The original 2 in 1 furnace for breakdown and holding in the same unit. Cold metal never reaches the molten bath. Assures metal of finest quality on all classes of work. Close temperature control. Can be used as a sweat furnace for reclaiming inserts. Is also ideal for all types of plants as tilting model above. Capacities from 350 lbs. aluminum up. Either type furnace may be fired by gas or oil, or combination gas-oil burners.



CHECK ON THESE GREAT STROMAN REVERBERATORIES THAT ARE THE ZENITH OF EFFICIENT AND ECONOMICAL ALUMINUM MELTING. DO IT TODAY!

Stroman makes all types of furnaces for the melting of brass, bronze, aluminum, magnesium, zinc, grey iron and all types of non-ferrous metals. Write for complete catalogue today.

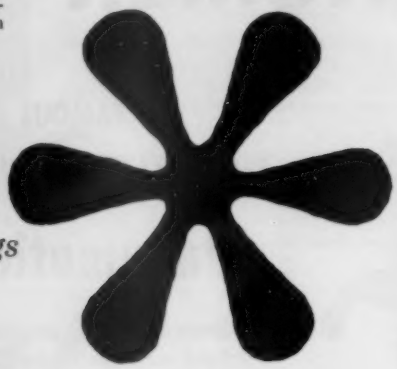
STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

For more information circle No. 77 on the Reader Service Card

Write our Metallurgical Dept. for FREE Copy of "Producing Leakproof Aluminum Castings."



for better castings
PLUS
higher quality
of finished products

* *specify alloys by*

The George Sall Metals Co., Inc.
2304 E. Butler St., Philadelphia 37, Pa.

PRODUCERS OF: *Aluminum, Brass and Bronze, and Zinc Ingot; Hardeners, Z-shot and bar for Zamak production, Salloy. Special Alloys*

"Better Alloys for Better Castings Thru Creative Metallurgy"

STROH

Has Been Producing Excellent ZINC DIE CASTINGS Since 1903

We are a bit proud of the fact that numerous of our customers are in the third generation.

"Teddy" Roosevelt was president of the United States when STROH first produced zinc die castings. The fact that we still serve many of these early accounts, we believe, speaks volumes for the excellence of our product.

Inquiries Invited:

STROH DIE MOULDED CASTING CO.
525 East Michigan St., Milwaukee 2, Wisconsin

For more information circle No. 80 on the Reader Service Card

PEOPLE
continued from page 14

The Cameron & Barkley Co. has been appointed as authorized distributor for the stainless steel valve, fitting and accessories of *Cooper Alloy Corp.*

Vincent A. Syriac has joined the sales force of *The Kindt-Collins Co.* in the New York, New Jersey, Delaware, Pennsylvania and Maryland areas.

John M. Lancaster and **Joseph V. T. Kempton** have joined the staff of *Fenwall, Inc.*

Lawrence F. Boland has been named vice president in charge of sales for the *Beryllium Corp.* Other newly elected officers of the corporation are **Matthew J. Donachie,** president; **William D. Gamon,** vice president; **Richard M. Quimby,** secretary and assistant treasurer; **Walter R. Lowry,** treasurer and assistant secretary.

Magnus A. Grunlan has been appointed plant manager of the *Dollin Corp.*

Magnus A. Grunlan

Robert V. Finch has been appointed manager of market development for the *Cowles Chemical Co.*

Two new appointments at *Illinois Institute of Technology* are: **Robert Filler,** assistant professor of chemistry, and **Liang Neng Tao,** assistant professor of mechanics.

Floyd V. Snodgrass has been elected vice president in charge of production, *Walworth Co.*

CASTING ABOUT

TO SAVE 424 POUNDS in the construction of their new "No. 4" gas meter, Rockwell Manufacturing Company have used a couple of very large aluminum die castings in place of cast iron for the housing. The new meter, believed to have the biggest capacity per pound in the world, is intended for industrial and commercial uses, weighs only 176 pounds (compared to 600 lb. for the comparable cast iron model), and is designed for working pressures up to 100 psi. Over-all dimensions are 33 x 27 x 19 inches. Stainless steel inserts provide long-wearing, corrosion resistant threads in the index plate holes on the cover, cap screw holes at the ends of the body, and in both the inlet and outlet.

BEFORE HYDRAULIC FIRES START is the title of a movie premiered before the meeting of the National Fluid Power Association in April. The movie, now available from Monsanto Chemical Company, features the use of Pydraul F-9 fire resistant hydraulic fluid wherever danger of fire is present in an industrial plant, such as a die casting shop. Reprints of the 16 mm black and white film are available from the company on request.

A $400-MILLION DOLLAR YEAR is what job die casters expect in 1955. First quarter experience has led The American Die Casting Institute, organization representing jobbing die casters, to predict the sharp increase in sales volume over 1953's $268,000,000 which was second best in history. The reason: auto builders are using many more pounds of die castings per car this year and expect to manufacture a record number of cars. These facts, plus the increasing use of zinc, aluminum and magnesium die castings by other consumer industries, point to the best year the die casting industry has ever had.

THE BLAST FURNACE and open hearth will find competition from powder metallurgy techniques, Dr. T. Keith Glennan, president of Case institute of Technology, told a college-industry conference of the Foundry Education Foundation recently. "Powder processes" he said, "potentially provide a direct tour from ore to finished parts and despite important limitations, powder metallurgy may be expected to develop rapidly."

LOOK OUT FOR GYPSIES, says the national office of the American Electroplaters' Society, who warns against "gypsy" platers who move from city to city in house trailers containing small plating shops. Good quality samples are offered, but poor quality work and exorbitant prices are said to be produced.

ONE SOURCE FOR DESIGN DATA on millions of dollars worth of ground equipment bought annually by the U.S. Air Force is now available. The "Handbook of Instructions for Ground Equipment Designers," or HIGED as the Air Force calls it, has been prepared by Becker & Becker, industrial designers, in coordination with the USAAF. The 400-page, liberally illustrated book will be available this summer to industry and federal agencies. It should relieve manufacturers of sorting through some 183,000 technical papers, journals, orders, catalogs, specifications, standards and other documents pertaining to the subject.

Continued on page 22

SERVING INDUSTRIAL AMERICA

★ QUALITY
★ SERVICE
★ DEPENDABILITY

Manufacturers of
Aluminum Alloy Ingots
Zinc Alloy Ingots

ALLOYS & CHEMICALS
MANUFACTURING CO., INC.

4365 Bradley Road
Cleveland 9, Ohio

ONtario 1-8600

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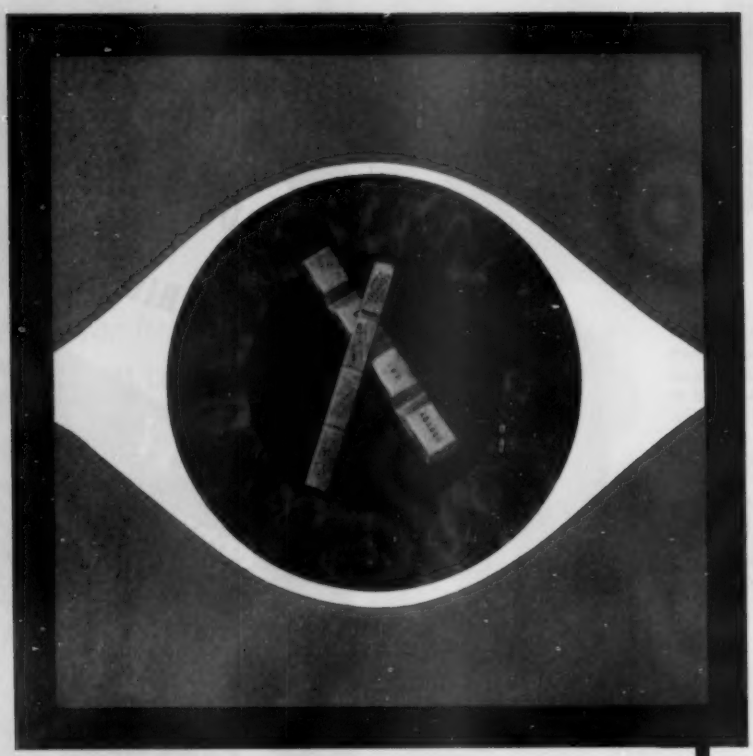


Let's look at the facts about die casting metals

Most people claim aluminum and zinc die cast alloys are pretty much the same wherever you buy them. Maybe. But that's not the point.

You want more than the *product* when you buy metal. You want *service* from your supplier.

Federated service gives you:

1. Research, constantly working to give you a new and better metal.
2. Practical Help, in your shop, by field experts whenever you have a metal problem.
3. Fast Deliveries; 14 plants across the country.
4. Metal Variety; any die casting alloy you need, aluminum, zinc or magnesium.

Try Federated metal-plus-service. It's the best metal plus the extra of competent technical help with your problems.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

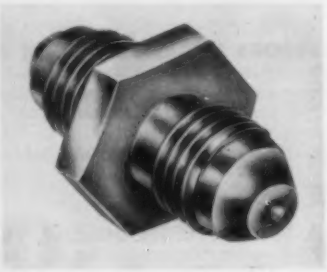
Aluminum, Magnesium, Babbitts, Brass, Bronze, Anodes, Zinc Dust, Die Casting Metals, Lead and Lead Products, Solders, Type Metals

For more information circle No. 32 on the Reader Service Card

CASTING ABOUT
continued from page 21

"STAINLESS" SURFACE ON FERROUS METALS is reported in a new method of diffusing chromium onto large or small metal products, giving a highly corrosion-resistant surface. Depth of the stainless surface ranges from .001 to .008; is said to resist thermal oxidation even at temperatures to 1700 F; and will not chip, crack, peel or gall when twisted 180°. Alloy Surfaces Company says that product can be welded either before or after processing.

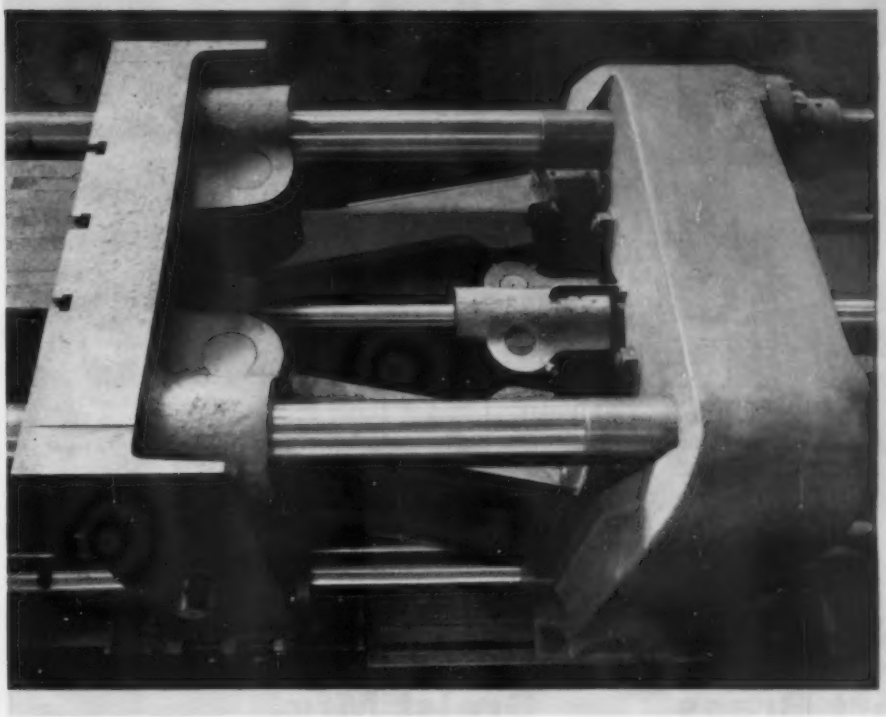
POROUS STAINLESS STEEL snubbers of type 316, designed specifically for the aircraft industry, have been introduced by Chemiquip Co.



The porous stainless steel disc is adjusted for use with any one type of material: hydraulic oils, aircraft fuels, air, gases, etc.

"ARMORED" MAGNETS are being made by die casting a ¼" shell of aluminum around the magnets at 2,000 psi. No special holding methods are needed to hold the magnets in the two-cavity die because the pull of the pre-magnetized

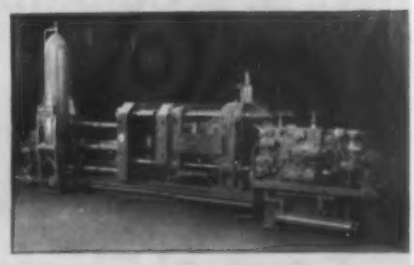
magnets automatically holds them against the cavity wall. They are ejected at 3,000 psi. This operation has recently been set up at the Edmore plant of Carboloy Department of General Electric. The magnet "insert" weighs ten times as much as the aluminum shell.



15% to 25% MORE CASTINGS PER DAY

with Wedge Cam Toggle

● Time saved on adjustments and die set up with Wedge Cam Toggle gives you from 15% to 25% more time in actual production. The Wedge Cam Toggle is an accurate, self-compensating clamp. It automatically takes up clearances in the dies caused by contraction and expansion of the molds during production or shut-down periods. Wedge Cam Toggle also makes it possible to set dies in a single cycle in many instances. Wedge Cam Toggle and "Pressure-Pac" Injection are two reasons why so many die casters are installing Lake Erie machines.



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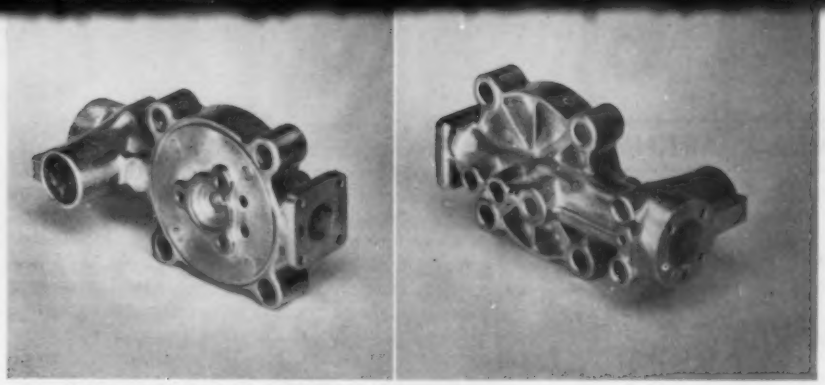


SAVINGS OF 80 PERCENT are reported due to conversion of these castings from sand cast brass to die cast zinc.

From Top To Bottom

die castings help to build this precision drill feed

DIE CAST parts are finding their way into both sides of today's production line. You'll find them being machined and assembled in the majority of metal products that are manufactured in large enough quantity to call for production-line setups. You'll also find them in the machines and tools doing the production line work.

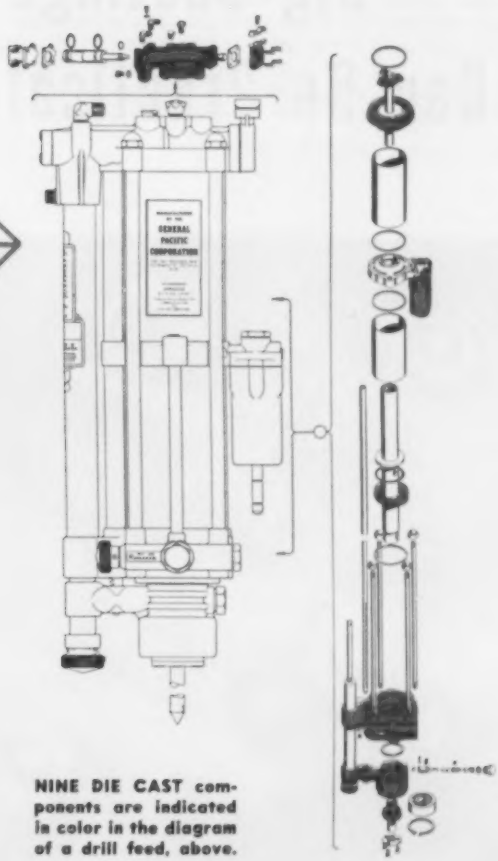
Here's a good example of zinc die castings that are used where heavy duty operation and the special requirements of pneumatic and hydraulic systems are involved.

The General Pacific Corp., Los Angeles, find they are getting better results at lower cost from nine zinc die castings that have replaced heavily-machined brass sand castings in their automatic drill feed units.

The drawing at the right, and photos top and bottom, indicate the location, function and shapes of these die castings, all produced by Los Angeles Die Casting Co. in zinc alloy (ASTM B86-46 XXV).

Two basic factors led to the redesign of these components from machined sand castings to die castings: exorbitant parts costs due to the large amount of machining required, and the excessive percent of rejects

Continued on page 121



NINE DIE CAST components are indicated in color in the diagram of a drill feed, above.

PERMANENT MOLD CASTINGS

To designers, new, heavier equipment means

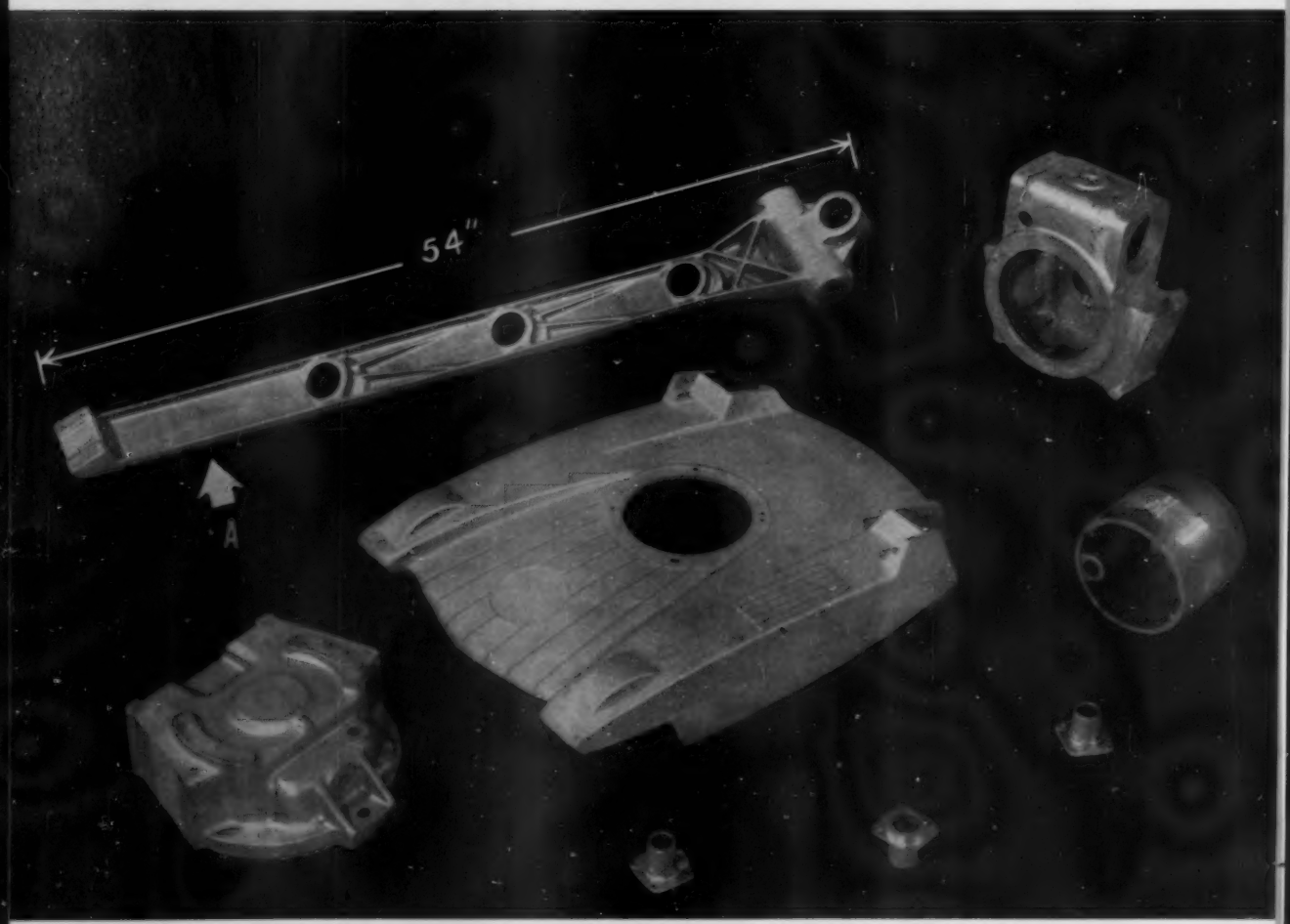
Big Castings Can Be Practical

IF you're accustomed to thinking of pistons, frying pans and griddles as typical permanent mold castings, you may be surprised to learn that a 100-pound aluminum permanent mold casting is practical. New foundry methods and equipment are extending the limits on weight and projected area of such castings.

Permanent mold casting is a gravity-pour process*, often using quite simple molds and clamping devices. As castings become larger or more complex, the nature of the mold changes. To pour a greater charge of molten metal and yet retain good dimensional accuracy in the casting, it is necessary to stiffen and reinforce the molds, arrange for more positive clamping of mold halves and devise ejector systems that ease large-area castings from the mold without distortion.

Here, for the designer and buyer of castings, is a report on: 1) how one foundry is producing over-

* For an outline of this process and its features, see "Permanent Mold Casting Process," PMM, April 1955, pp 44-50.



1. DIFFICULT EJECTION PROBLEM was encountered in 54" casting (A) which is held to 1/32" total variation from the mean dimension. Varied size and complexity of production castings is illustrated.

size castings, 2) examples from current production, and 3) suggestions of what to watch for in designing large castings.

What it takes to make large castings

Tooling for a large permanent mold casting is not simply an enlargement of the tooling that would be used for a small casting having the same general shape . . . the entire problem of pouring, cooling, resisting metal pressures, maintaining accuracy despite shrinkages, calls for more massive mold construction and heavier apparatus for clamping, aligning and ejecting. That's why the machine illustrated below looks more like a die casting machine than the conventional setup for making permanent mold castings.

This equipment has been designed and built to handle larger-than-average castings at Michigan Wheel Company's Permanent Mold Casting Division whose routine production includes castings in the 15 to 70-pound range.

One important comparison in molds: the conventional mold is completely integrated with its own clamping, core-pulling and ejection systems, but in this permanent mold casting machine, many of these functions are built into the machine. This means 1) the molds can be cheaper because much secondary "plumbing" can be omitted, 2) heavier holding, locking and actuating systems are practical than would otherwise be permitted, 3) alignment between mold halves is assured, 4) the casting operator has fewer motions to control and can therefore concentrate solely on the casting operation.

The drawing of this machine reveals the methods by which rigidity and alignment have been achieved . . . note the four-inch tie bars, the heavy rails for moving the mold together, the T-slot mold-mounting for quick set-up and interchange of dies, the heavy-duty hydraulic actuation, etc.

The labor factor and casting cycle are such that it is often possible to have the same operator running

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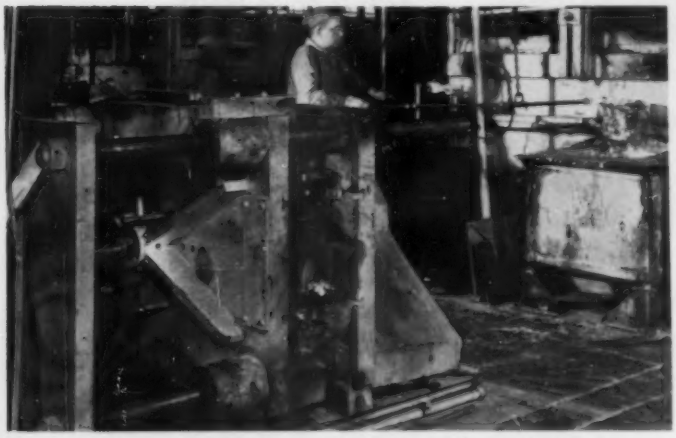
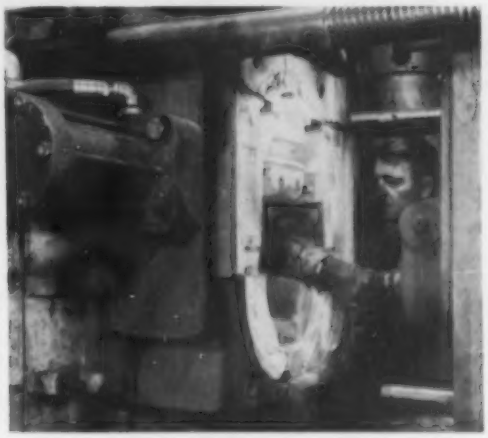
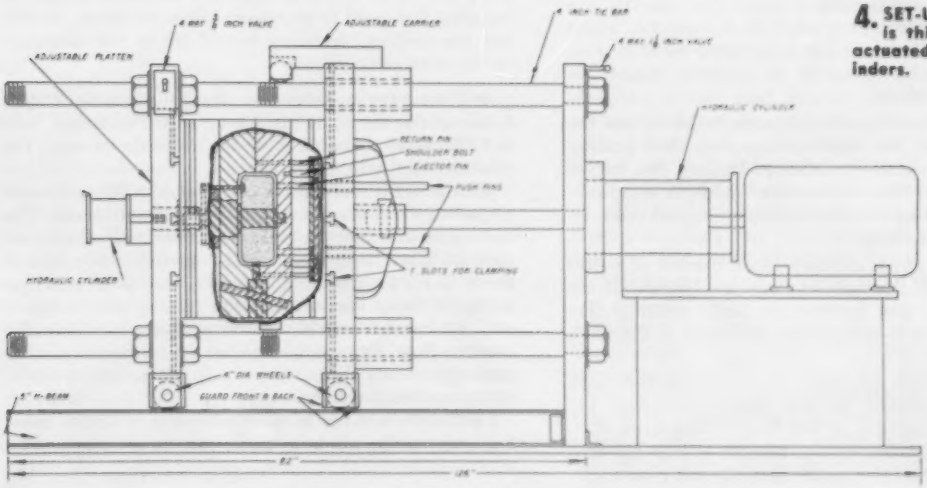


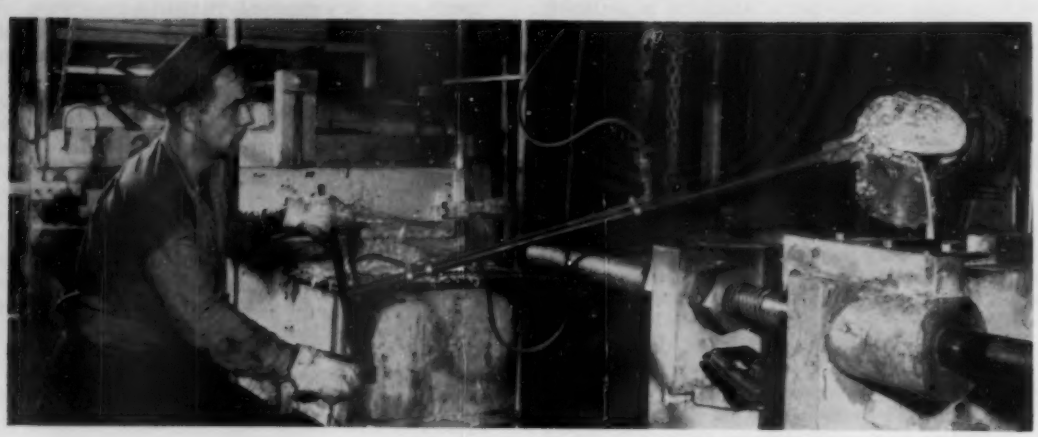
2. MASSIVE CONSTRUCTION of machine and molds resists pressure of molten metal, helps maintain accurate dimensions on extra-large castings.



3. PLACING SAND CORES for difficult undercuts solves problems of complex shapes at low cost than with steel cores.



4. SET-UP FOR CASTING is this rugged machine, actuated by hydraulic cylinders.



5. TORQUE CONVERTER housing (A) poses some special problems due to section variation, and tendency to stick to cover die.

6. POURING calls for ladle support by air hoist. Notice closeness of dip-out trough of reverberatory melting furnace.

two dissimilar jobs simultaneously. This usually involves one large, complex mold in a machine, along with a small casting in a hand-operated mold or two medium-sized jobs mounted on presses similar to those described above.

Sand cores are practical with large molds where the interior forms of the castings are such that pulling of a steel core would be difficult. In fact, the use of sand cores in simple, two-section molds is comparatively easy and sometimes permits lower tool costs by simplifying mold design.

The rate of casting in these large masses of metal is determined by the rate of heat dissipation. These molds for large-size permanent mold castings described here are air-cooled through holes in the back of each mold.

Pouring of large quantities of metal quickly and safely is accomplished by the chain hoist with air control setup. Location of the large breakdown furnaces is such that the dipout trough is directly behind each machine to expedite dipping and pouring.

Some large permanent mold castings

Three jobs in current production illustrate sizes, shapes and weights of castings considered practical, and some of the problems that have been solved. As Figures 1 and 5 reveal, large and medium sized castings are being produced.

- *Gear case housing* for a 20,000 lb. winch (not illustrated) is produced as a semi-permanent mold casting in aluminum alloy. The outside measurements are about 14″ x 20″ x 8″. In several sections, the wall is 2½″ thick and weight is about 70 pounds.

One interesting feature of this oversize casting is the closeness of dimensional tolerances: one 12″ dimension formed between two moving parts in the mold is held to ±.010, a degree of accuracy gained by building the mold to minimum tolerance limits, knowing the casting variation would lie in the direction of the maximum limits.

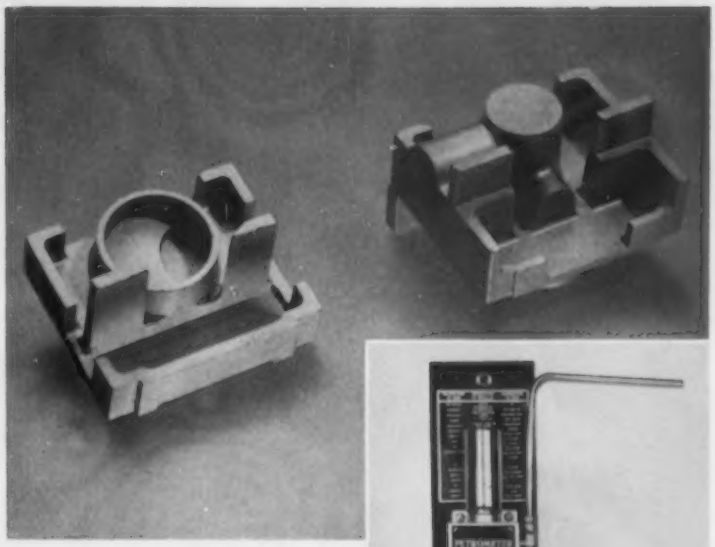
- *Frame for an automatic bowling machine,* Figure 1, measures about 54″ in its longest dimension, held to 1/32″ total variation from the mean dimension. The casting weighs 13½ pounds.

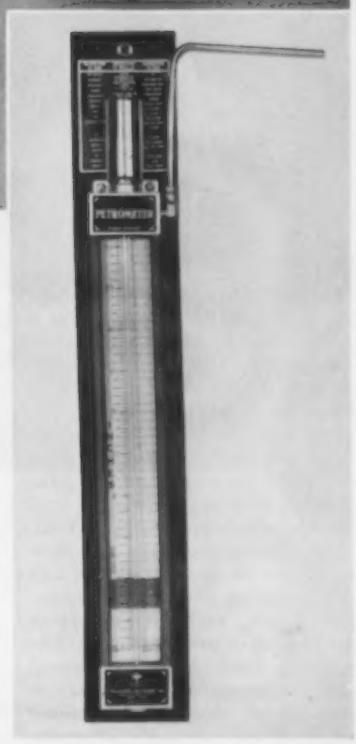
This difficult casting has cores set at a 30° angle and retracted through the cover half of the mold. The casting is also ejected from the cover half. Cores are held in place until the mold is open to make certain there is no distortion. Originally, the mold was operated without ejectors and the casting was "wiggled out" by hand to avoid distortion of the long, slender casting. Now, three small ejector plates have been installed to knock the casting out about ¼″, after which it is removed by hand.

Distortion was the greatest difficulty with this casting, especially as originally cast in 356-T6 alloy.

Continued on page 119

FIFTY PERCENT less machining is needed since these liquid depth gauge components were changed from sand to plaster mold castings.





SOLVED:
An Oil Seepage Problem

Loss of gauge oil was troublesome until a new type of casting was tried

By J. A. JAWETT, Chief Engineer
Liquidepth Indicators, Inc.

WHEN a large number of instruments are to be installed on a panel, anything that can be done to lower the total weight to be lifted, held, positioned and then fastened in place will pay dividends in better and faster installation, as well as in employer-employee relations. This advantage was realized by Liquidepth Indicators, Inc. when we changed from bronze sand castings to bronze plaster mold castings made by Atlantic Casting & Engineering Co.

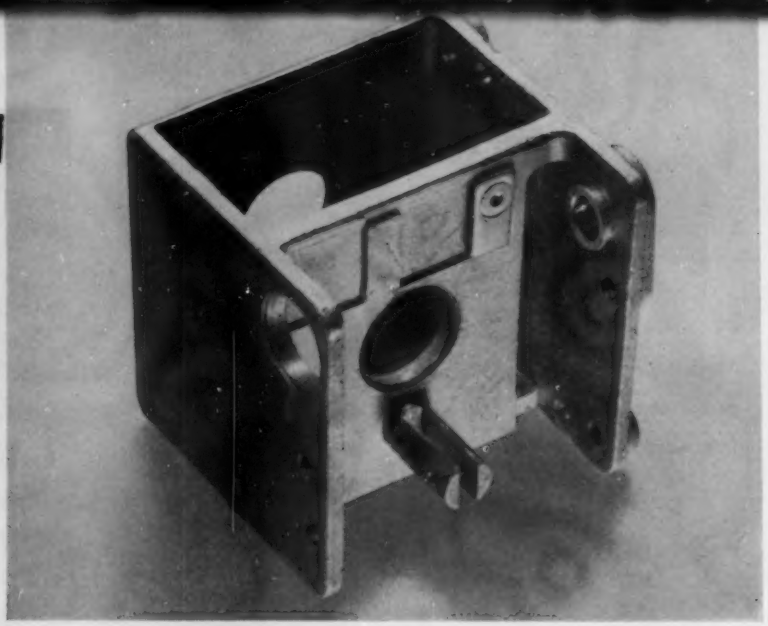
But reduction in weight was not the only gain. Since the two castings used in the Petrometer are both partly exposed, surface appearance is important. With sand castings, the entire surface had to be machined prior to painting to secure a satisfactory appearance; with the new plaster mold castings, painting the as-cast surface gives equal or better appearance.

The depth indicating liquid in these gauges is a chemical of very high specific gravity (2.95) and high surface tension—hence tends to seep through the most minute pores. Naturally, any loss of indicating liquid will throw the instrument off calibration, rendering it useless. When sand castings were used, an excessively high percentage of the castings were so porous that they had to be rejected. With plaster mold castings, not only is porosity reduced almost to the vanishing point, but this was achieved with far thinner wall sections.

Without counting the saving in surface finishing, the change to a plaster mold casting, instead of a sand casting, has reduced the finished piece cost more than 50 percent. Where formerly every surface had to be machined and several difficult and expensive machining operations performed, it is now possible to finish them by drilling and tapping.

INVESTMENT CASTINGS

This rigid investment casting greatly reduced machining



One-piece Steel Motor-mount Resists Severe Vibration

THERE are a tremendous number of applications where a low-speed, high-starting torque, fast-stopping motor is required. A typical example would be in opening or closing a valve. Standard electric motors do not possess these characteristics and it is necessary to add them by gear trains, oversize motors, and brakes, which is a costly process.

An impulse motor, on the other hand, can be used on almost any frequency up to some 400 cycles per second, including operation on half-wave rectifier input. The speed is controllable by limiting the amplitude of the armature core travel, among other methods, and the output torque is dependent upon the power input within the limits set by the armature winding.

Such a motor has the further advantage that there are no rotating electrical parts and general construction is quite simple. These motors, however, tend to be rather noisy.

The impulse motor developed and manufactured by The Viking Tool & Machine Corp., of Belleville, New Jersey, has all these advantages. In order to hold manufacturing costs as low as possible, the housing for this device is an investment casting in 1020 steel made by the Investment Casting Co. of Springfield, N. J.

Why this housing is investment cast . . .

• The accuracy and design flexibility characteristic of investment casting make it possible to cast this housing to such a degree of completion that the only machine work necessary after it is received from the foundry is to face several bosses and drill some of the holes for necessary shaft clearances and alignment. All of these operations are quite inexpensive. The major work is assembly which can be done by relatively inexperienced labor.

• The manufacturing saving possible through the use of investment casting is apparent. Were it necessary to machine this part from a sand casting, the most desirable shape, in many cases, could not be used since secondary machining costs would be prohibitive. Further, a sand casting would require machining all over to achieve the appearance. Thin walls are also required in order to reduce eddy-current losses.

• Assembly of the housing from sheet components is unsound because of lack of rigidity in such a structure. Since this motor is essentially a vibrator, the housing must be a monolithic structure to withstand the high frequency vibration of the motor.

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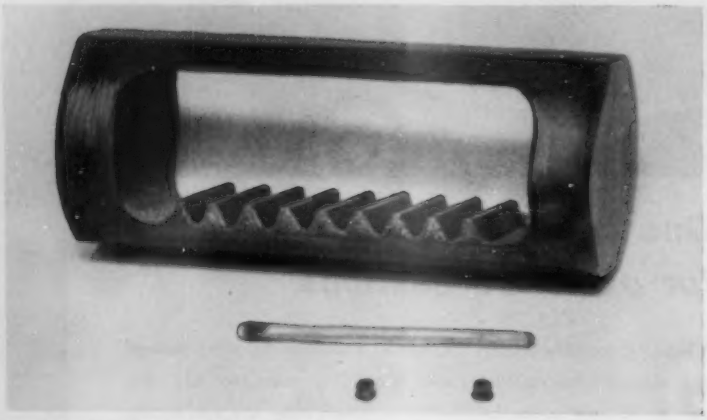
As a buyer of precision parts you should know

What Goes Into the Cost Of A Powdered Metal Part

By ALBERT L. FOX
Director of Industrial Engineering
The Yale & Towne Manufacturing Company
Powdered Metal Products Division



1. LARGER PIECES cost more, not only because of extra materials, but because more pressure is required to form, which calls for larger press and slower operating cycles. Internal rack and tiny bearings that are dwarfed by matchstick are examples of this.

2. COMPLEXITY of helical gear not only needs more direct labor than the flat spacer in forming, but increased die maintenance, slower pressing speeds and other factors need to be considered in setting costs.

IN the field of custom fabrication, the terms of which essentially describe the powder metal fabrication business, one of the keys of success is the ability to estimate costs of production in a manner which will assure a steady flow of business and still provide an equitable return.

It must be borne in mind that the producer of powdered metal parts is, as a custom fabricator, merely an extension of his customer's organization. In this capacity, there is an inherent responsibility to supply information of the highest degree of reliability.

Because of the comparative infancy of the process, most purchasers must rely upon the integrity of the fabricator, expecting that the part will be produced according to specifications and that delivery will be made as per schedule. Due to the lead time often required for complex tools, failure to comply with these two requirements sometimes leads to a "souring" of the purchaser on this process as he may only have the choice of adopting the substandard parts to his product, or rescheduling his operations in order to provide longer lead time.

In order to prevent this condition and instead foster a feeling of reliability, it is necessary for the fabricator to have a complete understanding of his process and a thorough knowledge of both fixed and variable costs. By virtue of this accomplishment it will be possible to all but eliminate those undesirable discussions between customer and fabricator regarding additional costs and/or lead time.

The process of estimating is essentially very simple once it is known what factors must be considered in arriving at the cost. Unfortunately, estimating "by the seat of the pants" or by using average costs per hour of work or pounds of powder required are, at the best, experience ratings and, as such, may not include many of the hidden but nevertheless all important cost factors.

Standard costing— Recommended method

There are several methods by which the true costs may be determined, but one which appears best suited to this custom fabrica-

tion field is that of standard costing. Basically, this is a technique where each individual operation required for the processing of the part is assigned a standard cost based upon carefully compiled cost records.

But then, this process is being traded upon as one of simplicity, adaptable to high speed production. What are the many factors which may be hidden or obscured, and thus passed over in the estimating procedure?

Steps in the process

For those newly associated with the process of powder metallurgy, it is believed desirable to enumerate the steps required to transform a customer's idea into a finished product.

- Initially, there is the interpretation of the customer's requirements which may be accomplished after discussing the design with the customer and the transfer of this interpretation into the design and manufacture of the tools.

- For the productive operations, there is the blending of the powder, the pressing of the part and its sintering.

- At this point, there may be added such operations as copper impregnating or steam treating, designed to improve the physical properties of the part; petroleum impregnation as an aid to lubrication; machining operations to cover design requirements which could not be built into the molding tools, or surface treatments such as rustproofing for corrosion protection or platings for corrosion and/or appearance.

- Finally, there is the packing of the parts.

- In addition, while not truly classified as operations, there are the very important factors of the engineering of the job, the cost of the tools to produce the part and cost of maintaining these tools in an operating condition.

While not all of the operations listed above will be required for the processing of a single part, in the preparation of the cost estimate for that part, each element must be carefully analyzed to insure costing in the proper manner. In this analysis, which consists of a review of the backup data leading to the estimate, the three basic elements of consideration are: 1) the number of parts to be produced, 2) the size of the part in area, volume and weight, and 3) complexity of the part.

How Many?

With regard to the number of parts to be produced, a factor which is significant from the production viewpoint is the one of engineering time. Within certain broad limitations, the same amount of time will be required for the process engineering and the design and manufacture of the basic set of tools for the 20,000 part order, the 200,000 part order, or the 2,000,000 part order, with the result that each part will bear a proportionate share of the engineering cost, depending upon the quantity to be produced.

While discussing the size of the order, consideration must be given as to whether it will be continuous or job lot production, and if the latter, the size of the lot. This factor forms the basis for determining the degree of automation that is permissible, and is especially true in the case of secondary operations, such as coining, sizing, tapping, etc.

Naturally, small orders will require hand labor, whereas large volume orders can often be tooled up for non-attendant operations such as a hopper fed sizing operation.

How Large?

Another factor which may be affected by the number of parts produced, though indirectly, is the cost of packing. If design specifications dictate a specific out-of-the-ordinary pack, it may be quite costly on the small order whereas it would be proportionately less expensive as the size of the order increases.

The size of the part will be paramount in selecting the press in which it will be produced. Directly related will be the setup costs of the particular press and its cyclic rate.

It is obvious that the inside rack shown in Figure 1 will have to be produced at a much slower rate than the bearing which is dwarfed by the match head. This is attributed to the fact that, for like materials, the larger the part, the more pressure will be required, which in turn, represents a larger press and slower pressing speed.

The sintering time required for the order is well established as each furnace can handle a certain capacity based upon its rating. However, by virtue of the requirements, it is very possible that a small order may use many times the allowed standard for setup time. As a result, while the required furnace time and its associated cost can be accurately determined, it may be found that the cost of sintering applicable to each part will be higher in the case of the small production order than in that of the large one.

Directly related to the part size is the method of packing and its corresponding cost. This is a factor always considered but many times underestimated. By way of an example, consider the small unit cost of packing the small bearing, shown in Figure 1, where several thousand may be bulk packed in an 8″ x 8″ x 8″ box with that of layer packing the same quantity of the inside racks in boxes strong enough to carry the required weight and bulk. The cost variance is further emphasized by the fact that for the two items considered, the ratio of costs is approximately 100:1 for the packing materials alone.

How Complex?

The third and final factor which will be considered—that of the part complexity—will have its first and most obvious effect on the initial cost of the tools. The cost of a set of tools required to produce a part having complex contours and shoulders of varying heights will be extremely high as compared to those required to produce a flat symmetrical part. An example of these opposites is the helical gear with a dog and the spacer, both shown in Figure 2.

Generally accepted must be the fact that the more complex the tools, the more die maintenance required, together with the increasing cost to maintain the tools in proper operating condition.

All other factors being equal, the direct labor required to mold a complex part will generally be higher than that for a simple one. This may be attributed to the slower pressing speeds usually as-

Continued on page 36

Thin mold walls . . . feature of frozen mercury investment castings

ONE of the most important features of the frozen mercury process of investment casting is its ability to produce parts with exceptionally thin walls, and often, parts which must also possess exceptionally smooth surfaces and intricate interior sections.

One of the principal reasons why the frozen mercury process can produce thin and dimensionally accurate wall sections, is the thin ceramic mold that is formed around the pattern, and which receives the molten metal after the mercury is melted out.

This thin shell, normally only ⅛-inch thick, enables gases formed by the incoming metal to escape readily through the porous ceramic wall, instead of creating a back pressure that might retard the proper flow of the molten metal.

These molds may also be pre-heated prior to the pouring of the metal to aid the flow of the metal. In certain instances, a vacuum is applied through the mold to speed the flow of the metal and to insure even distribution throughout the intricate passages of the mold itself. All these factors not only aid in the casting of thin walls, but in addition produce a structure of superior metallurgical qualities.

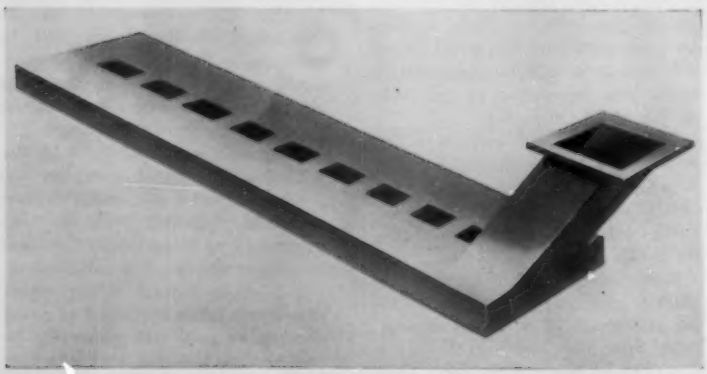
Frozen mercury investment castings may be the answer

For Your Large, Thin-Walled Components

By IRVIN R. KRAMER
Vice President, Mercast Corp.

16 Inches Long, 4 Inches Wide With .050 Wall

• An electronic part which also functions as a structural unit, Figure 1, is made of 356 aluminum. One of its walls is limited to a thickness of 0.050 ± .006. It is four inches wide, 16 inches long, is essentially a rectangular cross section, has a 120° elbow at one end, and is closed at the other. Rectangular slots are spaced through the top side into the interior passage over the length of the casting. It weighs approximately two pounds.



1. TO AVOID HAND TOOLING the inside of this large, thin-walled piece, or a difficult assembly job, frozen mercury investment castings are used.

Principal problems in the production of the part include the close dimension that must be held throughout its entire 16-inch length, its smooth interior passage with 63 microinch finish throughout, and the maintenance of extreme accuracy of straightness (within .020), throughout the length of the part. In addition, the part must be free from porosity and it must pass a 100% X-ray inspection.

The user company initially considered several precision production methods. While sand casting could have been used, a disproportionate amount of additional machining time would have been

required to bring the exterior walls down to the required tolerances. In addition to the time involved, the machining would have been overly costly.

Interior sections would have required both expensive and tedious hand tooling since these areas could only be cast to general shape and not to dimensional requirements. Because of the extremely thin sections, it was feared that hand tooling would have produced buckles and breakthroughs, thus causing complete rejection of the part.

Produced by the frozen mercury process of investment casting, the part can now be used as cast. Exterior surfaces require only a slight amount of additional fabrication, principally for joining of additional components.

Because of the booking feature of the frozen mercury process (the ability of the frozen mercury to form a perfect "weld" with just the slightest hand pressure), the pattern is produced in two dies, then booked prior to investing. The booking length is the full length of the part.

The frozen mercury process is considered the only economically feasible method for producing the part in its present form.

17 Pounds With .100 Wall

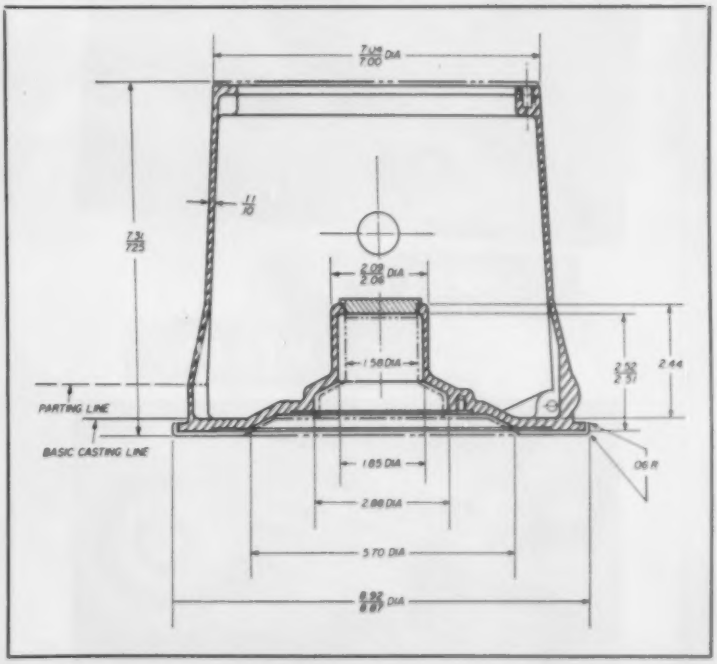
● The second example, Figure 2, is a part used by the aircraft industry. It is made of stainless steel, has a tapered cylindrical shape, and weighs 17 pounds. Overall, it is 7¼" in height, with a diameter of seven inches at its open top end, and a diameter of nine inches at its closed base. At its most critical areas, wall thicknesses measure only .100.

The part is hollow and its inside walls are smooth. Interior design features include an inverted chamber which is cast as part of the base, a cast-in-place tube from the chamber extending through the side wall, and a ring of bosses which encircles the upper inside rim.

The main problem in producing the part was the casting of very thin walls over such a large area, and maintaining the precise dimensions involved. Along with the .100 wall thicknesses range up to section thicknesses range up to ¾". Thus special techniques had to be worked out to feed these thick and thin cross sectional areas without cracking the part upon solidification.

In addition to this problem, the part demanded 100% X-ray and 100% Magnaflux inspection.

Because the part is of stainless steel, machining to tolerances was again economically non-feasible. In fact, the machining of interior sections could not, under any circumstances, meet dimensional requirements. Produced by the frozen mercury process, the part requires the very minimum of machining. A total of five booking operations is required to produce the part.



2. FEEDING THICK SECTIONS through the extremely thin walls of this 17-pound aircraft casting called for special techniques.

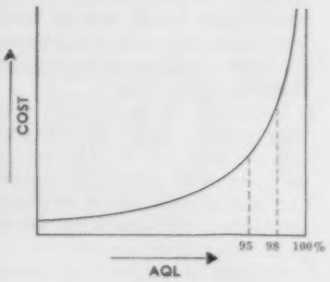
POWDER METAL COSTS
continued from page 33

sociated with complex parts and the fact that these parts often require hand pick-off from the molding press.

Finally, as in the case of the part size, there is that often underestimated factor of packing. As a result of design characteristics of either a mechanical or chemical nature, the packing may have to be tailored to the part, which will introduce costs well in excess of bulk or even standard layer packing.

Another element which is always prevalent, regardless of the number of parts to be produced, their size or complexity, is that of the "cost of quality." Most fabricators can produce to the quality level desired, but by the very nature of the process, the costs will rise at an increasing rate as the AQL rises. The chart in Figure 3, while not a result of plotting specific points, indicates a trend.

Having discussed the various factors which may materially affect the cost of producing a particular part, the question may be raised as to the reason for presuming that some of the factors were hidden or obscured from the fabricator and, as such, were not included in the cost. *It has been the experience of large users of powdered metal parts that quotations having extreme spreads in prices for identical quantities of the same part have, and are being submitted. Tempering their observations with the knowledge that not all companies have the same fixed expenses or operate on the same margin of profit, the extreme spreads in price range which are being encountered give rise to the belief that all factors were not considered.*



3. THE COST OF QUALITY is represented by this chart which shows, in a general way, how increase in acceptable quality level affects piece costs.

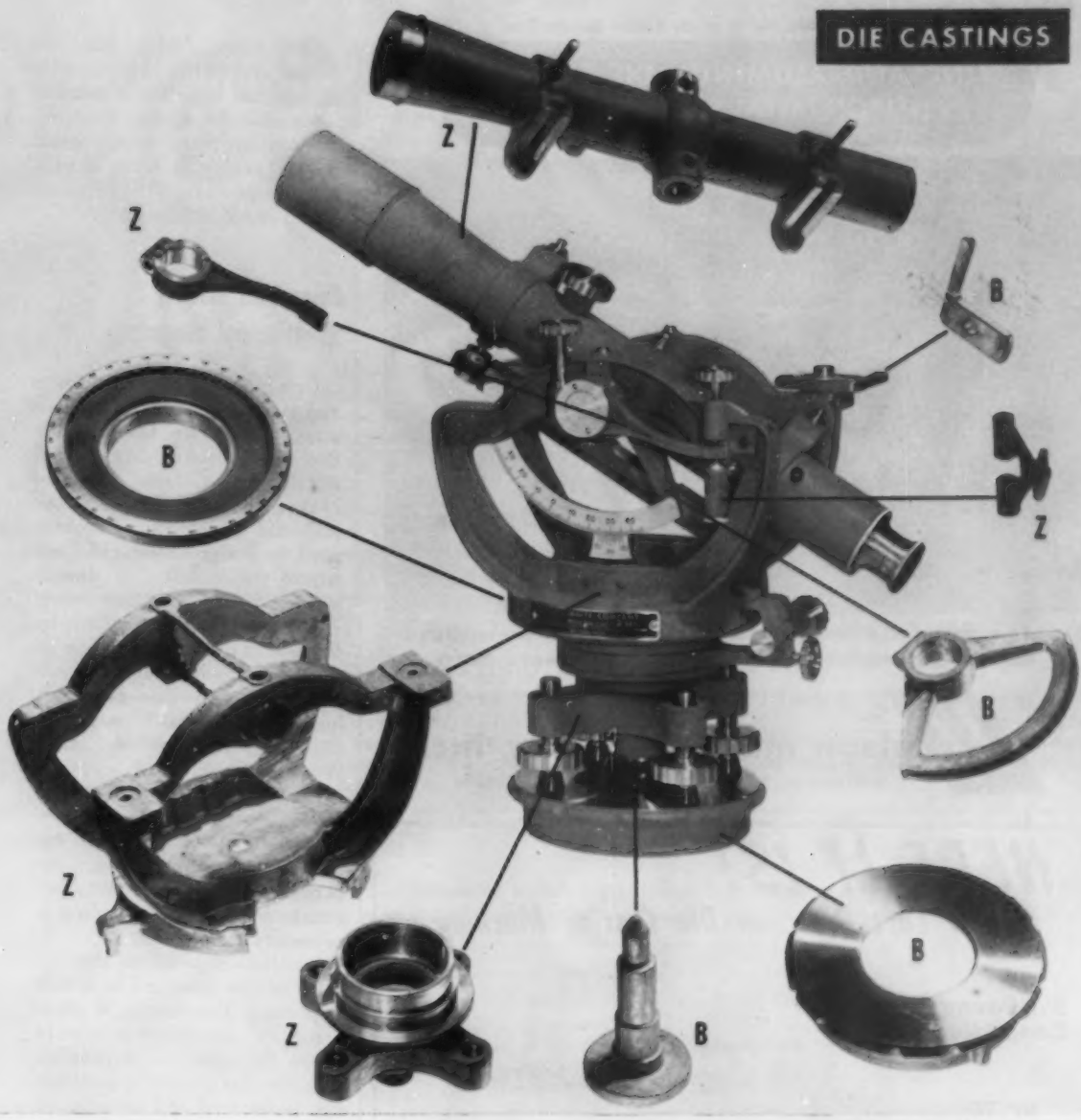
It is believed that by increased study of the variable cost factors and shedding a little light on those which may be hidden or obscured, it will result in hastening the maturity of this dynamic industry.

HYDRAULIC CONFERENCE

The 1955 Fabricating Machinery Hydraulic Conference, sponsored by Vickers Inc., has been scheduled for May 17 and 18 at the Hotel Statler, Detroit, Mich.

Attendance at the conference will be by invitation only, and will include representatives from the manufacturers and users of metalforming machinery, die casting equipment, etc.

For more information circle No. 12 on the Reader Service Card



*Legend: Z = Zinc alloy; B = Brass Alloy

In Precision Instruments... More Die Castings

By ROBERT J. OUDINOT, Chief Production Engineer
David White Co.

OVER a period of years, the die casting industry has made such great advances that today precision optical instruments can be built largely of die cast parts with the assurance that there will be dimensional stability.

The ability to do intricate coring together with close dimensional accuracy in the as-cast condition, likewise, has helped in acceptance of die castings by the optical goods industry.

Almost traditionally, transits and levels have had their major structural parts machined from brass or bronze forgings, sand castings or wrought stock. With the development of stable die casting alloys, there has been a noticeable shift to die castings in zinc, aluminum and brass.

Continued on next page

For more information circle No. 64 on the Reader Service Card

ZINC AND ALUMINUM DIE CASTING
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Not only is the original cost extremely low, but operating costs are so low that the machine will soon pay for itself. Actual tests operating 8 hours a day, 5 days a week, show total cost of gas and electricity of ONLY 17 CENTS PER HOUR!

All models of American Die Casting Machines are easy to operate and all contain features and workmanship of larger and much costlier machines.

Other outstanding features include — all steel welded construction — 80 ton locking pressure — automatic electric cycling at high speed — 17-3/16" x 17-3/4" die platens — 6½" die stroke — highest grade controls and valves mounted for easy maintenance and accessibility — a complete package with self contained unit.

Available in Air or Hydraulically operated plunger goose-neck type for zinc, tin or lead, or, cold chamber type for aluminum, brass and magnesium.

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One other factor that has helped to bring about this change has been the increasing labor charges, so that any production method which could show a saving in labor is welcomed, provided the product would serve satisfactorily.

Dimensional stability for structural components

One manufacturer of transits and levels to change to die cast components is the David White Co., of Milwaukee. In the transit illustrated, both zinc and brass die castings are used, but it should be noted that they are used as major structural parts where the stability of dimensions and position is imperative.

The savings made possible by the use of die castings are well illustrated by the standard casting. Formerly, this part was made in brass as two pieces, separately machined and then securely fastened together. Matching holes and pivots tended to complicate the machining and make it more expensive. As a die casting, however, coring is sufficiently accurate so that only reaming is necessary for alignment.

Parallelism between the two sides of the standard is highly important. Previously, a slight error in machining would throw the sides out of parallel. In a die cast standard, parallelism is secured and maintained simply by casting a relatively thin web across the top, as shown. When the casting is machined this web is removed. Since warpage will only occur when the casting is being removed from the die or during cooling, this thin web has been found adequate.

One other example of impressive saving due to the use of die casting is in the brass leveling base and the zinc leveling body. Formerly, these parts were fully machined from either solid stock or castings. Since die castings have become practical and economically available, all of this machining has been eliminated.

Product Standards For Die Castings

TO aid designers in establishing the most economical level of engineering specifications for normal die casting production, the American Die Casting Institute has drawn up a series of product standards.

In March and April, three of these product standards were published in PMM, and printed here is a standard for flatness tolerances. In June will be published charts showing standards for draft on walls.

The complete series of standards will cover about 40 different subjects on engineering, metallurgy and commercial practices. So far, five have been released.

Additional copies of the Standards are available without charge. If you want a set, drop a request to the editor, PMM, and we'll forward it to the ADCI.

PRODUCT STANDARDS FOR DIE CASTINGS

ADCI-E5-55T
FLATNESS TOLERANCES

NOTE — The values shown herein represent normal production practice at the most economic level. Greater accuracy involving extra close work or care in production should be specified only when and where necessary since additional cost may be involved.

TOLERANCES FOR FLATNESS

Flatness shall be measured with a feeler gauge from three widely separated points on a continuous plane surface of the die casting.

FLATNESS TOLERANCES — As Cast	
Dimension* of Die Casting	ALL ALLOYS
Basic Tolerance up to 3 inches	.008"
Additional tolerance (inches) for each additional inch	.003"

*Dimension means maximum dimension (diameter of a circular surface or diagonal of a rectangular surface).

AMERICAN DIE CASTING INSTITUTE, INC.
366 Madison Avenue New York 17, New York

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PEOPLE IN THE NEWS
continued from page 20

Nicholas S. Muccilli has been appointed plant manager at *National Lead Co.*, Perth Amboy plant; **Robert A. Putney** has been named assistant to the manager of the metal department.

O. A. Pfaff, president and general manager of *American Wheelabrator & Equipment Corp.* has been elected to the board of directors of *Bell Aircraft Corp.*

Stanley P. Sax has been appointed director of research in charge of process and product development for the *American Buff Co.*

R. K. Rawlins has been appointed district manager in the Texas-Louisiana area for *Lindberg Engineering Co.*

Charles H. Lundquist has been elected president of the *Western Sealant Co.*

John E. Srawley has joined the *Arwood Precision Casting Corp.* as standards engineer.

Stanley W. Moulton has been appointed to the engineering staff of *Hitchiner Mfg. Co., Inc.*

Louis Srybnik has been appointed director of special projects div. of the *S. & S. Machinery Co.*

Dr. A. Eugene Schubert has been named manager of engineering of *General Electric Co.*, chemical materials dept.

Dr. John Chipman, head of the Department of Metallurgy, *Massachusetts Institute of Technology* has been awarded The Bessemer Gold Medal by the Iron and Steel Institute of Great Britain.

Ralph W. Bailey has been named sales manager of the continuous-cast products dept. of *American Smelting and Refining Co.*

Milton Harmon has been appointed as eastern representative of *Cast-Master, Inc.*

Wallace J. Keith has been appointed sales engineer in the newly opened sales office in Dayton, Ohio of *Acheson Colloids Co.*

The *F. J. Stokes Machine Co., Inc.* has opened a district sales office in Mt. Vernon, N.Y. with **J. C. Coleman** as district manager. A branch office at Union, N. J. has also been opened with **Ralph H. Stalbaum** in charge. In the Philadelphia district for the company, **William J. Leighton** has joined the staff as sales engineer.

Robert J. Polacek has been appointed to the sales development section of the Product Development Dept. of the Chemical Div. of *Celanese Corp. of America.*

Gordon Kiddoo has been elected vice president in charge of development for the *National Research Corp.*

IN THE WEST IT'S . . .

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S[illegible]t the

195[illegible] Metal Powd[illegible]

• May 10[illegible]

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EX[illegible]BI[illegible]TS

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Alloy Met[illegible]owders, Inc. (10)
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Lindberg Engineering Co. (14)
Materials and Methods (33)
Metal Hydrides, Inc. (8)
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Stackpole Carb[illegible] Co. (2)
F. J. Stokes Machine Co. (15-16)
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PEOPLE IN THE NEWS
continued from page 20

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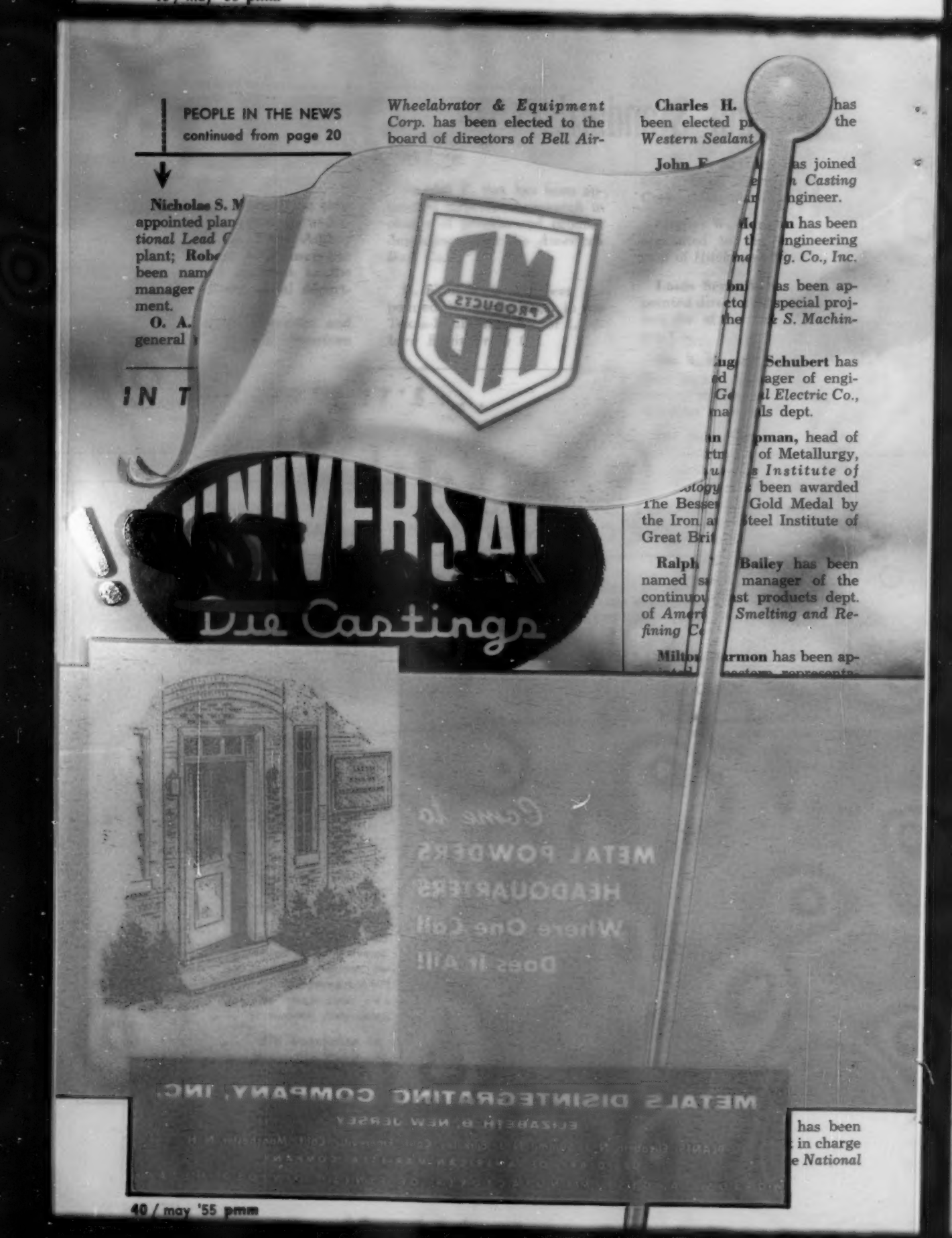

See you at the

1955 Metal Powder Show

• May 10-12 • Bellevue Stratford Hotel • Philadelphia

Powder metallurgy, in all its aspects for designer, buyer, producer and supplier, will be the topic of discussion and display for three days beginning May 10 in Philadelphia.

For the eleventh time, The Metal Powder Association presents its annual meeting and, in conjunction, the 1955 metal powder show. In simultaneous sessions running through Wednesday and Thursday, papers will be offered on general powder metallurgy and also, on electronic cores.

Attendance is expected to surpass last year's mark of 800. Officers of the association during the past year are: Paul E. Weingart, American Metal Co., Ltd., president; William E. Cairnes, Radio Cores, Inc., chairman of the board; Robert L. Ziegfield, secretary-treasurer; Morris Boorky, The Presmet Co., vice president.

EXHIBITS

Exhibitors at this year's MPA show include fabricators of powdered metal parts, producers of powder and equipment and publications. Registration at the exhibits is free, although there is a fee for attending meetings. Both are open sessions. Those exhibiting, together with booth numbers, are:

Alloy Metal Powders, Inc. (10)
Antara Chemicals (9)
Baldwin-Lima-Hamilton Corp. (34)
Chicago Powdered Metal Products Co. (12)
Colonial Alloys Co. (17)
Drever Co. (5)
The Electric Furnace Co. (1)
W. J. Fitzpatrick Co. (24)
Charles Hardy, Inc. (26)
Hoeganaes Sponge Iron Corp. (19-20)
Kux Machine Co. (21)
Lindberg Engineering Co. (14)
Materials and Methods (33)
Metal Hydrides, Inc. (8)
The New Jersey Zinc Co. (30)
Plastic Metals Div., National Radiator Co. (13)
Precision Metal Molding (11)
Selas Corp. of America (22)
The Sharples Corp. (23)
Stackpole Carbon Co. (2)
F. J. Stokes Machine Co. (15-16)
Vanadium-Alloys Steel Co. (28)
Whitaker Metals Corp. (31)
Yale & Towne Mfg. Co., Powdered Metal Products Div. (6-7)

PROGRAM—GENERAL

Nine papers on general subjects relating to powder metallurgy, and seven on the electronic core industry, are scheduled. Topics to be discussed include:

Wednesday AM

Finishing and Plating Metal Powder Parts, C. C. Cohn, Colonial Alloys Co.

The finishing and plating of powdered metal parts is an accomplished reality. Seven phases of finishing to attain high corrosion resistance and decorative finish are discussed.

Machining Metal Powder Bronze Bearings, W.A. Irvine, The Maytag Co.

The Maytag Co. machines bronze bearings used in their home laundry equipment. Practically all are from powdered bronze. Several critical factors affecting machinability of powdered bronze bearings learned in investigating difficulties of tool wear and dimensional instability to years ago, and methods for obtaining trouble-free machining, are reported.

Prealloyed Steel Powders and Their Applications, G. A. Roberts and A. H. Grobe, Vanadium-Alloys Steel Co.

Properties of prealloyed steel powders, mechanical properties of test specimens made from these powders, and typical applications are discussed. Powders discussed are: 4630 A powder (0.30% C, 2% Ni, and 0.30% Mo) and the stainless steel powders of AISI types 302B, 316 and 318.

Continued next page

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Wednesday PM

Carbide Tooling for Pressing Metal Powders, T. A. Wilson, National Carbide Die Co.

General discussion of tungsten carbide compacting dies will include feasibility of tungsten carbide punches and core rods, and will touch on problems of mounting, grade selection, engineering unusual applications, causes of failure, and work now being done to make better dies in shorter time for less money.

Economic Production of Metal Powder Parts in Small Volume, B. I. Horton, Pitney- Bowes, Inc.

Case history reveals how Pitney-Bowes, five years ago, set up a small powder metal department for short runs and has now converted about 150 structural parts and bearings with resulting dollar savings and improved properties.

The Effect of Copper Additions on Iron Powder, P. Ulf Gummeson, Hoeganaes Sponge Iron Corp.

Copper powder is frequently added to iron powder compacts to increase hardness and strength. Although various iron powders show different dimensional change characteristics, a general pattern can be observed, linked to physical properties of the iron. Desired values of hardness and strength can be obtained with less copper and lower sintering temperatures than with normal practice.

Thursday AM

Iron Powder Metallurgy in Europe, S. I. Hulthen, Hoeganaes-Billesholms, Aktiebolag.

History, current production statistics and specific data on iron powders for welding, cutting and scrafing, and chemical purposes are reported. Types of powders used, pressing, tooling and sintering practices, a review of present activities, and an estimate of future trends, are included.

A Powder Producer Looks at Titanium, J. F. Sachse, Metals Disintegrating Co., Inc.

Great progress in developing titanium as a commercial metal has been brought about with help from powder metallurgy techniques. Many newer processes may yield a powder product. Future may see development of large sheet production without the need for expensive melting operations.

A Fabricator Looks at Titanium Powder Metallurgy, H. W. Dodds, The Brush Laboratories Co.

Pro's and con's of powder metallurgy methods for fabricating titanium parts and billets are covered, including two basic fabrication processes (hot pressing and press forming). Both processes are described with discussion of applications now suitable for each. Physical properties are reported.

PROGRAM - ELECTRONIC CORES

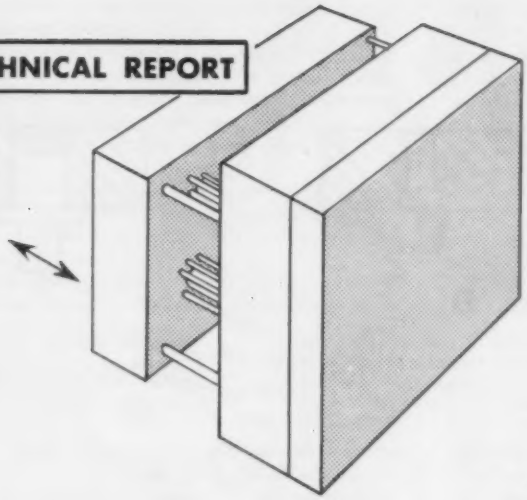
Wednesday AM

Method of Specifying Iron Powder Cores, C. E. Cherry, Jr., Metal Powder Association.

The use of MPA Standards as guides to designers in selecting iron powder cores for electronic applications includes: types of cores, preferred sizes, manufacturing considerations, and mechanical and electrical considerations.

Continued on page 50

TECHNICAL REPORT



Common Ejector Requirements:

1. Sliding movement of ejectors must have a positive stop so working ends of pins will be flush with cavity surface.

2. Endwise adjustment must be permitted so that ends of pins can remain flush with cavity surface.

3. Ejectors must be properly guided and amply supported within the bearing holes in the die half, yet have good working clearance to avoid binding when die is heated to working temperature.

4. Ejectors should have some "float" sidewise so that pins can align themselves with bearing holes in the die to compensate for variations due to heat.

A noted British consultant gives you his

Guide To Ejector Pin Mounting

BY W. M. HALLIDAY

THE ejector system of a die casting die should be worked out completely at an early stage in the development of a die design to obtain the most efficient, rapid and safe ejection of castings.

Too often, designers leave ejector details until late in the procedure, until the die has been partially built or even, in some cases, until it is ready to be set up for proving tests. While such tests may reveal important points that bear upon the kind of ejector system to use, the fact that the die is already in its final stages precludes what otherwise appears to be the best form of ejection. Thus, inferior or troublesome ejector mechanisms are used in order to minimize alteration of completed portions of the die.

The same degree of care and intelligent anticipation of ejection problems must be applied during designing, as is bestowed upon other critical features such as the die cavity layout, runner/gate feeding system, coring, etc.

Ejector design can have great effect upon:

Flash — It can be minimized or located on nonvisible, unimportant surfaces to reduce finishing costs and give better appearance.

Distortion and inaccuracy — Many casting defects can be traced to some unsatisfactory feature of the ejection system. Distortion, cracking and inaccuracy are among these. Castings that have large unsupported areas of thin walls or are deeply cored at considerable spacing, may distort, stretch or crack during ejection. Dimensional inaccuracies on hole sizes, center distances, etc., also may arise from improper ejection.

Speed of casting — The die movements directly related to ejection and manipulation of the ejector mechanism ordinarily take from six to eight times as long as the movements closing the die and injecting the charge. For this reason, ejection offers one of the most fruitful fields for reducing the duration of casting cycle. Poor ejector design or construction will slow the casting cycle.

Opening and closing of the die, actuation of cores, injection of molten alloy are controlled automatically by the machine setting and, in practice, usually take from *three to ten seconds.*

Time required to operate the ejectors, strip the casting from the cores, and clear the die, may range from *20 to 45 seconds,* plus a delay of *five to 15 seconds* after injection to permit the casting to solidify.

Die life and maintenance — Failures such as bending, seizure, misplacement or complete fracture of push rods, stripper-sleeves, ejector rail guides, rod fastenings, etc., may directly associated with shortcomings of the ejector mechanism. These portions of the die are most likely to become overstressed due to the high pressures and temperature variations occurring. These defects call for extra maintenance and supervision, inflating ordinary production costs above the economic level.

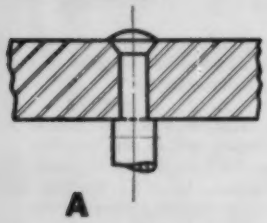
With most die casting dies, ejection is effected by a series of cylindrical push-rods that slide simultaneously through the movable die half, forcing the casting from the stationary cores or deep cavity.

The push-rods are positively mounted on a sliding ejector rail, guided upon substantial pillars affixed to the movable die half, and arranged to slide perpendicularly to the main parting line of the die.

The die is designed so that the casting will cling to the core or cavity walls of the movable die half carrying the ejectors. The ejector rail and push-pins generally operate mechanically with sliding movements derived from normal die-opening motions.

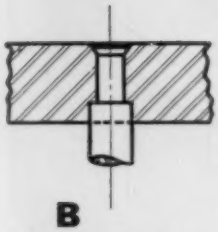
On the following pages, 17 methods of fastening ejector push-pins to the ejector rail are described and illustrated.

RIVETING



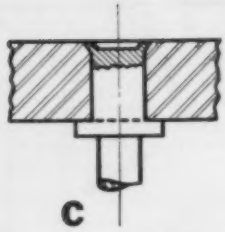
A

One end of push-pin is slightly reduced to fit tightly in hole in ejector rail. Pin shank is peened over into shallow conical recess.



B

Shoulder of push-pin fits firmly into stepped diameter of hole for maximum resistance to side-bending tendencies.



C

Integral narrow collar, twice the diameter of the projecting end, fits against rail. Dished end of shank facilitates riveting.

A very common design and toolmaking practice is to rivet the push-pin to the ejector rail. As with cross-pinning, this method is fast, simple and low cost, but has some undesirable features.

Effectiveness of the fastening shown at "A" (above) depends upon several factors: when the shank is riveted, the latter must draw the square shoulder smartly against the rail; the shoulder must be machined perfectly square so that the projecting portion of the pin will stand perpendicular to the rail; care must be taken to avoid bending the working end of the push pin during riveting; on small push pins (up to ¼" diam.) it will be difficult to obtain a shoulder with sufficient face to ensure square setting of the pin.

Riveting should be performed with both pin and rail heated to normal working temperatures. Further, the length of the hole into which the reduced pin shank fits should be twice the diameter to obtain good fastening.

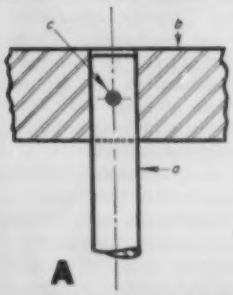
All factors described above are difficult to attain, and create a tendency toward bending or breaking of push-pins during operation. Pins with small diameter shanks are particularly prone to fracture across the base of the shoulder if subjected to side binding pressures, excessive rubbing, etc. This type of fastening is only recommended for small, simple dies where light ejection pressures occur and where a thick ejector rail can be used.

The design at "B" (above) presents similar problems, and the larger the shoulder, the more accurate the pin setting. Both arrangements are difficult to adjust for lengthwise alterations, and generally, new push-pins would have to be fitted.

Although the diagram "C" (above) is more costly, it is preferable. Since the shank fitted into the rail has a larger diameter than the working end, it is rigid and strong; the riveting arrangement requires only light hammering and reduces the risk of bending the working end.

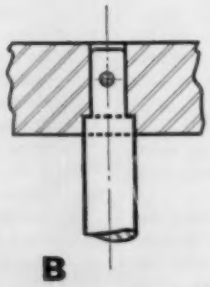
Riveted fasteners do not permit sidewise "float" and therefore, holes must be very carefully aligned axially. Most forms of riveted fixings will be unsatisfactory, inconvenient and far from durable, especially for complex dies having many push-pins.

CROSS-PINNING



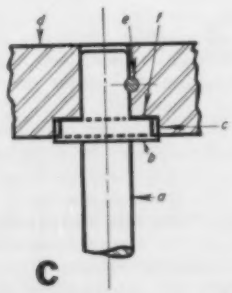
A

Push-pin (a) is a straight length of ordinary precision-ground steel rod, press-fitted into a hole in soft mild-steel ejector rail (b) and positively retained against endwise or turning motion by stop-pin (c).



B

Push-pin is slightly reduced in diameter to form a shouldered shank at the rail end. Square shoulder butts firmly against step in hole. Retention is by stop-pin diametrically through the pin shank.



C

Push-pin (a) has an enlarged collar (b) setting within recess (c) in the rail (d). Full-diameter shank is press-fitted into rail hole. Tapered stop-pin (e) fits closely in tapered hole with half its diameter in the push-pin shank.

Simplest and least expensive method is to fasten the ejector pin to the ejector rail by cross pinning. Several drawbacks make this practical only in very simple dies where the push pins perform the lightest duty.

Drawbacks of design "A" (above):

1) Unless the push-pin is very tightly pressed into the ejector rail while heated to normal working temperatures, the entire ejection thrust must be

borne by the small cross-pin (c) which must, therefore, be large and strong.

2) Small diameter ejectors (1/16" to ⅛") that are used to minimize collar-flash cannot be cross-drilled. Unless the ejector pin is more than ¼" in diameter, strong enough cross pins cannot be used, since the diameter of the latter cannot be more than 1/3 that of the ejector pin.

3) Endwise setting of the ejector relative to the rail and cavity wall cannot be adjusted to compensate for slight dimensional variations, misalignments or to counteract wear.

4) Endwise adjustments can be made only by drilling a larger cross-pin hole and repositioning the push-pin, using a larger cross-pin. This is practical only for larger diameter ejector pins.

5) Too much production delay accompanies any change, since the ejector half must be removed from the machine and the ejector rail stripped of pins that are to be changed.

6) Push pins anchored in this fashion speedily work loose due to elongation of the cross-pin hole, causing thick flash on the casting surface or eventual rupture of the ejector pin.

Some of these objections have been avoided in design "B" (above) which gives shoulder-step engagement to take the full ejection thrust, safeguarding the cross-pin against bending or breaking. It also ensures positive endwise location.

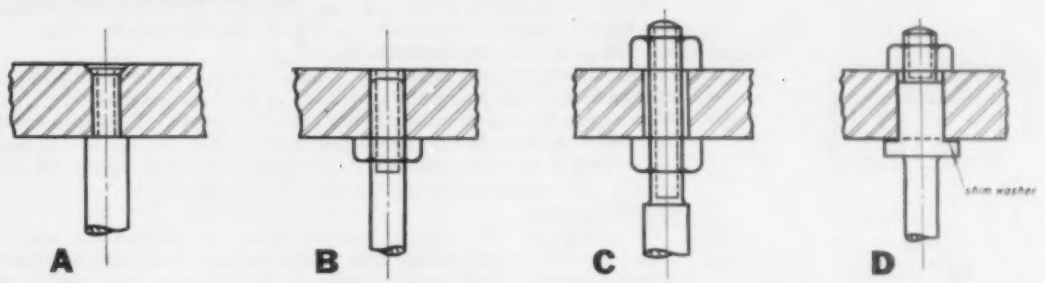
Here, the cross-pin must withstand only the relatively light frictional drag between the ejector and its guide hole when the ejectors are being returned to casting position ready for the next injection.

Drawbacks of this design include: difficulty in endwise adjustment; risk of unduly weakening the ejector by reducing its shank diameter; breakage may result from side-binding or thrust against the projecting part of the ejector.

More satisfactory, but still recommended only for light duty in simple dies, is design "C' (above) which is easier to adjust for pin setting. If the ejector has to be advanced from the rail, it is necessary only to remove the tapered stop-pin, place a shim (f) behind collar (b) and replace the tapered pin. To depress the ejector pin further into the rail, the required amount of metal can be faced off from the underside of the collar (b) with a lathe. The tapered pin will then engage or can easily be adjusted.

All three of the above arrangements entail a rigid locking of the push pin in the ejector rail. Thus, they cannot be used where the ejector pins have to "float" sidewise to engage holes whose center spacing may vary due to heating when the die is in use.

SCREWED FASTENING



A — Push-pin has reduced threaded shank screwed into tapped hole in rail so that square shoulder locks against side of rail. Opposite end of shank is riveted into a shallow countersink.

B — Parallel push-pin is employed, threaded at one end for screwing into the rail. An ordinary hexagon lock-nut bearing against the underside of the rail locks the pin in place.

C — Push-pin has slightly reduced threaded shank, considerably longer than the rail thickness. Shank passes through clearance hole in the rail and is held by lock nuts at each side of the rail.

D — Push-pin has enlarged shank with diameter twice that of working end. Shank may be tightly fitted into a plain hole in the rail or mounted in a clearance hole for sidewise "float".

Retention of push-pins by simply screwing them into a threaded hole or by using lock nuts is very common practice. Of the conventional designs shown above, "A" and "B" should be avoided, while "C" and "D" are the most satisfactory.

Poor working performance results from "A" (above) because: 1) push-pin alignment is determined by closeness of fit and accuracy of threaded portions, often resulting in side-binding, stiff operation and fracture of push-pins during operation; 2) riveting frequency results in bending the working end or damaging threads, making removal of worn pins difficult; 3) adjustment of pin setting or replacement of pins will be difficult; 4) sidewise float cannot be provided; 5) unless the push-pin is of large diameter, undue weakness occurs at the thread root adjacent to the shoulder; 6) perpendicular relationship between pin and rail is difficult to establish.

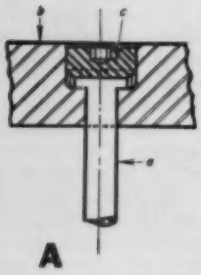
One practical feature of design "B" (above) is that the push-pin can be easily adjusted relative to the rail, often without dismantling the mechanism, even while the die is hot.

Preferred arrangement is shown at "C" (above) because it is easier to make endwise adjustment of pins, and because pin alignments are not determined by thread engagement. By using lock nuts at each side of the rail, a degree of "float" is obtained.

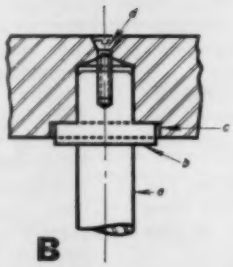
One objection to "B" and "C" is that full ejection pressure is borne by threads in the rail hole or on the pin. Frequent stripping of threads makes a costly maintenance problem.

Most satisfactory of these, and also, most expensive to install, is "D" (above) which is free of the objectionable feature described above. To gain "float", two lock nuts can be used, fastened together on the shank.

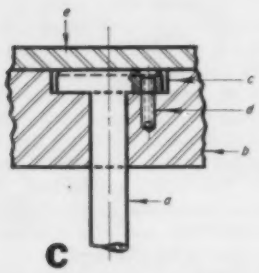
LOCKING SCREW



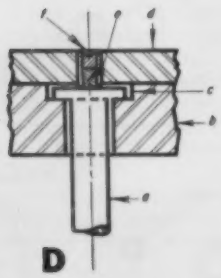
Push-pin (a) has enlarged, narrow head that may fit tightly or with clearance in hole at rear of rail (b), tapped for Allen-head locking screw. The screw (c) presses against pin head and receives full ejection thrust.



Push-pin (a) has collar (b) sunk in shallow clearance recess (c) to take ejection pressure. Short shank, fitting in smaller hole in rail, is held by V-head screw (d) inserted through rail.



Push-pin (a) has head with diameter three times that of shank, recessed in rear of rail (b). Recess (c) is same depth as head on the pin. The pin is kept from turning by V-head screw (d) passing through pin into tapped hole in the rail. Back-plate (e) is fastened to rear of rail.



Headed push-pin (a) with head in recess (c), is held by two headless grub pins (e) and (f) through the regular back plate (d). Clearance around head, permits sidewise adjustment; depth of recess (c) permits endwise adjustment with shims.

The use of a locking screw to secure the pin to the rail is also common. Two typical constructions (above) are well adapted for large dies where injection pressures are considerable.

Adjustments are not difficult to make: forward or backward adjustments are made by facing the underside of the head or shimming, while sidewise "float" is accomplished with two lock screws. These lock screws are locked together so that one bears lightly against the push-pin head, yet permits it to move sidewise. Adjustment of pin setting can be done without dismantling other die members, or removing the tool from the machine platen.

The design at "B" (above) cannot easily be adapted for sidewise "float" but has the advantage that push-pins can be located accurately, retained securely, held perpendicular to the rail face, and readily adjusted endwise.

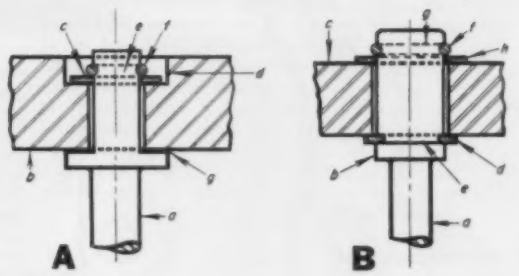
Both of these constructions are very compact so that a number of push-pins can be located in a small area. Another advantage: no portion of the fastening devices project beyond the rear surface of the rail, simplifying mounting the back plate to the ejector rail. Neither recessing or slotting to clear nut heads is required. Also, even when no back plate is used, the reciprocating striker rod of the machine, which bears against the ejector rail, will make simple contact on the uninterrupted face of the latter.

Two other uses of retainer screws are frequently resorted to by tool makers. The plan "C" (above) is practical for push-pins whose working end must be small in diameter, but this form of fastening is not easy to arrange for sidewise "float". Endwise adjustment is easy by using shims or removing material from the underside of the head. Full thrust of ejection is taken by the back plate when the push pin advances into the cavity to eject the casting.

Equally efficient is the design at "D" (left), which has the added merit of allowing the push-pin to float, or be locked in accurate alignment with the guide hole. This design is particularly suited for use with relatively thin ejector-rails or where push-pins require frequent adjustment in amount of projection from the rail or penetration within the die half.

Design "D" is most compact and adjustment can be made without dismantling the rail from the die half. By removing the back plate, the push-pin can be drawn backward out of the die in the easiest manner. Both of these designs are superior from a maintenance angle.

SPRING SNAP RINGS



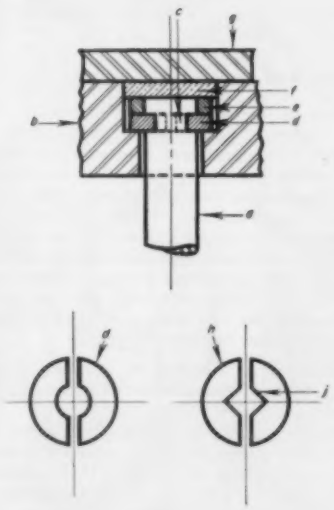
A. Push-pin (a) has large collar to locate squarely against rail (b). Pin shank is free fit in clearance-sized hole. Hardened steel washer (c) fits over upper pin shank in recess (d). Annular groove (e) holds split snap ring (f). Thickness of washer (c) must be carefully determined so that collar is held firmly against front side of rail. Shim at (g) advances push pin into the die.

B. Push-pin (a) has large cylindrical shank (b) with diameter at least 1½ times that of working end of pin. Shanks passes into clearance hole in rail (c) and hardened steel snap-ring (d) fits into annular groove (e). Ample OD of ring helps withstand ejection pressures. Second spring snap-ring (f) fits in annular groove (g) and bears against hardened steel spacing washer (h) that prevents endwise movement.

Although not widely known or adopted, split tempered-spring snap-rings can provide very effective and economical fastening. Commercially available in a variety of sizes, shapes and spring strengths, snap-rings are simple, inexpensive and time saving, since they require no drastic machining alternations in the rail forms.

Advantages of this method of fastening push-pins include: 1) snap-rings can generally be placed at *accessible* points in the ejector rail, permitting endwise adjustment or removal without dismantling the die; 2) snap-rings take the smallest amount of space in the rail, permitting close location of push-pins; and 3) snap-rings can be fitted to permit sidewise "float" of push-pins for accurate alignment and smooth operation.

A NEW METHOD



Push-pin (a) with both ends faced flat and square passes through clearance hole in rail (b). The hole is accurately counterbored to about twice the smaller diameter. Shallow annular groove (c) receives two halves of split washer (d) made of hardened, ground steel formed by sawing a solid washer. Second hardened steel washer (e) is bored for close fit around pin above annular groove. Clearance around washers allows sidewise float of pin. Circular disc (f) is hardened steel, and lies flush with rear surface of rail. Backing plate (g) holds all washers firmly in place, and disc (f) bears on end of push-pin. Disc (f) is ground on sides to the required thickness to permit the push-pin to move sidewise under constraint of the guide hole in the die half.

To assemble, the backing plate is withdrawn, push pin inserted from the rear of the rail with split washer in place. Next, the second washer is placed over the pin head, the hardened disc inserted, and back plate attached. In some cases, it is advisable to anchor the ejector pin against sidewise float. This is accomplished simply by using a modified split washer (h) with a square hole (j) sawed across the diagonal.

A comparatively unknown method of push-pin retention (above) meets satisfactorily most of the requirements for ejection listed earlier, and has a number of advantages: working efficiency, ease of application, simplicity of adjustment, and standardization of parts for replacement inventory.

Push-pins and other parts are of simple shape and inexpensive to produce; washers and disc can easily be standardized in a few sizes for fixing a large range of push-pin sizes, and can be made up in substantial quantities for economical tool maintenance requirements. Likewise, standard counterboring tool sizes can be provided for machining recesses in the ejector rails, so simplifying toolmaking.

The fastening can be adapted to retain the push-pin in fixed position, or to float sidewise, and the entire fastening arrangement can be incorporated in a very thin ejector rail. This type of mounting permits close spacing of pins.

For servicing, push-pins can be removed from the back quickly by retracting the backing plate while the rail remains mounted on the die or in the ejection box.

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Quality of Magnetic Powder Cores for Military Applications, E. Both and D. Elders, Signal Corps Engineering Lab., Fort Monmouth, N.J.

In a comprehensive evaluation program carried out jointly by the Signal Corps, the Bureau of Ships and the National Bureau of Standards, 141 core materials produced by 11 manufacturers were tested for effect of humidity and temperature cycling, hot and cold storage, and salt spray upon permeability, Q values, electrical resistance and mechanical strength. Results obtained at the Signal Corps labs will be summarized in the form of quality ratings, according to characteristics most important for military uses.

Wednesday PM

The Various Iron Powders Used in Electronic Cores, J. A. Roberts and G. O. Altmann, Antara Chemical Div., General Aniline & Film Corp.

After a brief history of iron powders and high frequency magnetic cores, the different production methods of iron powders are reviewed. High frequency properties are discussed, along with practical applications such as tuning cores, loop antenna cores, intermediate and high frequency antenna cores, etc.

Ferrite Antenna Cores, C. A. Grimmett, General Electric Co.

Theory of operation of the ferrite cored antenna, and the effect on performance of various factors such as shape, wire size and material, are covered. Core materials available to date, with pro's and con's of each, and a list of ideal characteristics, are described.

Threaded Cores (A panel), moderator, R. D. Ponemon, Pyroferric Co., Inc.

Thursday AM

Trends in Ferrite Core Design for TV Yokes and Flybacks, C. E. Torsch, The Rola Co., Inc.

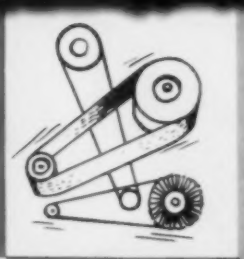
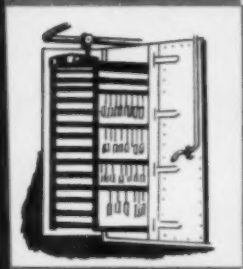
Ferrite as a preferred magnetic core material is discussed, stressing the ability to channel or shield pulsating magnetic energy with low loss. Sales competition for TV sets, and nickel oxide scarcity, have forced shift to full use of ferrites and core standardization has begun. In 6 years, ferrites have permitted 13-fold enlargement of picture size with small change in cabinet, equipment size and costs compared to 1948 devices without ferrites.

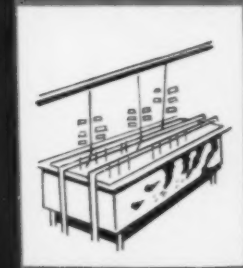
Application of Ferrites to Memory Systems, W. N. Papian, Massachusetts Institute of Technology.

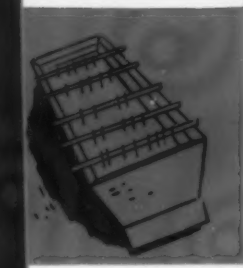
Storage of pinary information in the magnetic field of ferrite ring provides a neat solution to one of the problems in the digital-computer field, the problem of "remembering" and making available a large number of binary "words" rapidly and efficiently. Highly rectangular hysteresis loops, high speeds, low losses, low driving requirements, excellent quality and uniformity, and reasonable cost, are among characteristics required in these materials.

Application of Ferrites to Deflection Components, B. V. Vonderschmitt and W. H. Barkow, Radio Corporation of America

Measurements necessary to define the figure of merit of ferrite core materials for use in horizontal deflection transformers and deflection yokes are discussed. Correlation between simple bridge measurements and actual performance is presented.





PMM

Finishing Section

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

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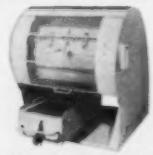
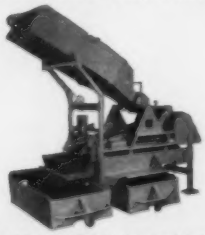


MODEL 32"—TWO COMPARTMENTS

MODEL 24"—TWO COMPARTMENTS



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All the machining on the casting is done by the foundry and is limited to facing and tapping operations. These operations are: Wall plate — machine and tap four holes; Base—machine and tap holes; Valve body—tap hole; Valve slide—no machining.

In the plating operations, the most critical operation is racking the parts. This is particularly critical when flat anodes are used on odd shaped pieces, and if improperly done, will result in shadows and a reject for the plating department.

Some difficulty is encountered in plating the base of the dispenser because of its shape and the poor throwing power of a chromium bath is the reason. *The successful application of chromium plating to articles of irregular shape depends largely on racking the work to obtain as nearly a uniform current density*

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As the machined castings are received, there may be vestigial parting lines and there are always trim and sanding marks that must be removed prior to plating. The sequence of operations, then, to produce a finished part ready for assembly, is:

1. Grind to remove trim and sanding marks. A sewed, four section canvas buff treated with 120 grit emery is used. This step is only employed when necessary and is not a standard step on all parts.

2. Cut down or polish with a "satin wheel". This is a canvas wheel charged with a mild abrasive to remove the marks left by the 120 grit emery.

3. Coloring or buffing to a bright finish before plating is accomplished with a soft cotton-flannel wheel.

4. Direct chromium plate. Immediately after coloring the parts go into the plating bath. The bath is a chromic acid-sulphate composition, maintained at the proper chromic acid to sulphate ratio by periodic analysis. The bath is operated at 114 F, using 200-300 amps per tank load, current density at 6 volts.

5. The parts then go through the drag out tank and three hot water rinses at 180 to 200 F, followed by air drying.

6. Coloring is the final step, using a soft cotton flannel wheel with a lime colorant.

Direct chromium plate—Cont.

as possible over the cathode surface. Special anodes would give a better plate but would also cut down on production.

With present procedures, a satisfactory job is secured as evidenced by many years of service. Wear on three of the parts in the dispenser is severe and the chromium provides a wear-resistant surface other than the standard zinc die cast.

One other die casting used by the West Disinfecting Co. is of interest. One model of liquid soap or detergent dispenser has a brass die cast mounting fork. This casting is cast, trimmed and sanded at the foundry. Plating is by the West Co. using the same set up and the same procedures as described for the zinc die casting. As in the cast of the plated zinc parts, both salt spray tests and field experience have shown that the direct chromium plate, is thoroughly satisfactory for the service conditions encountered.

Why was this process chosen over the more usual plating procedure? Lower capital investment and lower operating costs are the reasons.

At the time the design was worked out, adequate plating facilities were available to do the job. With the same plating facilities, a copper-nickel-chromium cycle could be used, but the dull or cold nickel as used here in the plant would make it necessary to buff nickel. *The present system shows a 30 percent labor saving over using dull nickel.*

By employing a bright nickel process, the labor costs would be comparable but a relatively great additional investment in equipment would result in an increase in final plating cost.

Use modern impregnation methods to

Eliminate Leakage of Airborne Castings

By **LOWELL PALMER,** President
American Metaseal Mfg. Corp.

INCREASED stresses of present-day flying—high altitudes, great temperature and pressure fluctuations — emphasize the problem of microporosity in cast components. Fluid leakage due to microporosity impairs accuracy of airborne instruments, cabin pressurizing equipment, as well as pumps, valves and other fluid handling units.

Design engineers specify aluminum and magnesium castings for such components as instrument housings, pumps and valves because of the advantages inherent in such processes as die casting, sand casting, shell casting and permanent mold casting—intricate shapes; undercuts; complex coring; smooth, streamlined contours; and one-piece construction. Impregnation permits designers to use castings instead of more costly processes requiring much greater machining and finishing added to higher assembly costs.

Leakage from pressure-tight systems is only one of the results of microporosity. Corrosion and failures in metal finishes are also a direct result. Many unsightly failures of applied finishes are caused by internal corrosion, and effective impregnation of micropores will prevent them.

Castings are impregnated by three different methods, which are listed in military specification MIL-I-6869:

1. *Internal Pressure*—All openings in the casting are blocked except one. The impregnant is placed inside the casting and pressure is applied until it forces its way through the "connected" pores in the casting. (This type of impregnation is useful only to prevent leakage, and may overstress the casting.)

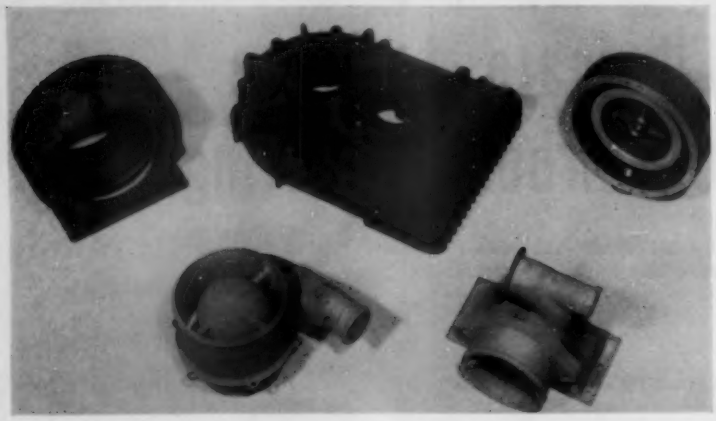
2. *External Pressure*—All openings in the casting are blocked except one connected to a vacuum pump. Reduced pressure inside the casting sucks the impregnant into the "through" pores. (This type of impregnation will only seal "through" porosity, and is ex-

Continued next page

Table 1: How Physical Properties Compare . . .

	Sal ammoniac in water	Sodium silicate	Sodium silicate with solids	Phenolics	Tung oils	Styrene with linseed or dehydrated oils	Modified flexible polyesters	Styrene polyesters	Styrene polyesters, copper stabilized
Percent Solids (Range)	——	32 to 45	35 to 50	50 to 75	40 to 70	50 to 70	90	94 to 97	94 to 97
Method of Application	Internal Pressure	Internal pressure	Internal pressure	Batch	Batch	Batch	Batch	Batch	Batch
Impregnating Ability — Microporosity	Fair	Good	Fair	Fair	Good	Good	Good	Good	Good
Impregnating Ability — Macroporosity	Poor	Poor	Good	Fair	Poor	Poor	Poor	Good	Good
Exudation Characteristics	None	Exudes above 250 F	Exudes above 250 F	Exudes badly	Exudes	Exudes	Exudes	Very little	Very little
Stability in Metal	Poor	Etches Al or Mg if used on both	Etches Al or Mg if used on both	Good	Good	Copper inhibits cure	Copper inhibits cure	Copper inhibits cure	Good
Cleanliness after Impregnation	Rusty Castings	Fair	Good	Poor	Poor	Poor	Poor	Good	Good
Resistance to Metal Finishing Solutions	Fair	Poor	Poor	Good	Good	Fair	Good	Good	Good
Resistance to Boiling Water and Steam	Poor	Poor	Poor	Good	Good	Fair	Fair	Good	Good
Chemical Resistance	Poor	Poor	Poor	Good	Fair	Fair	Fair	Good	Good

"Successful sealing of microporosity opens many new applications for castings in aircraft."



ROUTINE IMPREGNATION of castings for aircraft is accomplished on a simple, one-man Metaseal process equipment at Stratos Division of Fairchild Engine and Airplane Corp., Bayshore, N.Y. Complete unit occupies less than 40 sq. ft. of floor space without baking oven. Unit includes autoclaves, high vacuum pump, wash tanks, mechanical surging device and power hoist.

tremely slow due to the small pressure differential.)

3. *Batch-Type Vacuum Pressure* —The castings are placed in a pressure vessel or autoclave. A vacuum pump removes air from the autoclave, and any pore connected to the surface of the casting, whether it be continuous throughout the casting wall or not, will be evacuated. At this point, without breaking the vacuum, the impregnating material is introduced with compressed air; such pressure forces the impregnant into the evacuated pores.

The casting is never under extreme stress, because the pressure, even if high, is equal both inside and out. At the end of the cycle, pressure is released, the castings are removed from the autoclave, and cleaned.

After cleaning, a drying, baking, or curing operation solidifies the liquid impregnant which has been absorbed into the metal structure.

The first impregnating method used (for cast iron) was simple weathering, which produced enough iron oxide in areas of through porosity to block ordinary leakage. This effect was often automatically achieved during the aging necessary to produce a stress-relieved machine part.

With the advent of artificial aging, rusting in the pores was accelerated by filling the part with water to which various inorganic salts (e.g. sal ammoniac) had been added, and applying pressure to force the solution out through the pores. This method is still used on some large ferrous castings that rust easily and are subject to low static pressures.

When time is at a premium, the impregnant should leave solids of a different nature than rust in the pores. The favored material of this sort was sodium silicate containing up to 60% water, and applied by internal pressure. It surface-sealed cast iron against those conditions for which rust was an effective sealant. Various solids—usually metal oxides and sometimes fibrous materials such as ground asbestos—were added to the sodium silicate to seal inner connecting porosity.

Because of the shortcomings of these impregnants and leak-stopping methods, many natural or synthetic oils and resins or mixtures thereof were tried; some are still in use. Tung oil, a drying oil often used in paint formulation, was found to be effective in stopping leakage due to microporosity of the type found in magnesium castings.

To improve penetration the viscosity of the tung oil was lowered by additions of compatible materials such as xylol or other benzene derivatives. Xylol does not enter into the polymerizing action and escapes as a gas, either before or during the curing treatment.

Synthetic resins such as the phenolics were tried next on aluminum or stainless steel. These resins are corrosion resistant, but can be ued only in solutions containing as much as 50% of solvents such as acetone or alcohol, which do not enter into the polymerizing reaction and must be driven off. Also, the phenolic polymerizing reaction produces water vapor, and this must also escape.

Because neither drying oils nor synthetic resins were effective impregnants for both fine and coarse porosity, the next developments were mixtures of both drying oils and resins. The styrene monomer can be made to co-polymerize with linseed oil or with dehydrated castor oil, producing a rubber-like solid that is suitable for sealing some castings against leakage. However, since large proportions of styrene are required, it acts in effect as a solvent, and a good deal of it is volatilized while the penetrant is jelling.

Thus, all the above-mentioned impregnants, including soduim silicate, must be considered in connection with solvents which must be evolved or driven off during the drying or curing treatment. Paragraph 3 of military specification MIL-I-6869A states that the impregnant used in aluminum or magnesium castings should not be of a superficial type but should be capable of producing a solid, continuous structure

throughout the porous section of the casting wall.

During the last war, new types of synthetic resins were developed for molding products in which the reinforcing material was glass fibers. These resins, mixtures of polyesters and styrene, co-polymerized and form a thermosetting solid. Their outstanding feature is that there is no evolution of water vapor or other volatile matter; they are considered to be 100% solid, since there is practically no volume loss during polymerization.

The inherent advantages of the polyester-type impregnant made it far superior to all previous types. Improved since its development, newer polyester-type impregnants do not jell at room temperature or require refrigeration, agitation or aeration. The viscosity is maintained at the correct value and remains constant throughout the impregnation cycle.

A second basic improvement is an increase in the "wetness" of the new impregnant. This enables it to penetrate into the micropores; also it eliminates the necessity of volatile solvents such as acetone for subsequent cleaning. Table I lists comparative properties and operating characteristics of all of the various types of impregnating materials and methods.

Results of Effective Impregnation

Using batch-type vacuum pressure systems and a modern polyester-type impregnant, all metals containing "connecting" porosity can be effectively impregnated. The first and most obvious result of such treatment is prevention of leaks in pressure service.

If the porosity is in such a form as to cause little or no distortion in the casting wall, a properly impregnated casting can be pressure tested to destruction without any leakage; many experimental magnesium and aluminum castings have been proof tested in this way.

Bronze castings have also been successfully tested under hydraulic pressures as high is 6000 psi.

Corrosion Prevention — An equal, if not greater, benefit derived from proper impregnation with modern materials is the prevention of both chemical and electrolytic corrosion. Studies have demonstrated that porous areas are extremely susceptible to electrolytic corrosion. Inclusions of foreign material generate electromotive forces in the presence of an electrolyte, sometimes destroying a casting internally without appreciably changing its surface.

Electrolytic action will also enlarge and drive surface porosity deeper; it may completely penetrate the casting. This is especially true of bronze and stainless steel castings, such as pump casings, in contact with corrosive liquids.

Proper impregnation effectively prevents the damage from spreading by corrosion, as well as "fills up" the initial porosity. This greatly increases the normal life expectancy of such parts.

A related advantage is the protection of surface finishes. For example, if the anodizing solutions penetrate the walls of aluminum castings, gas will be generated in such pores, come to the surface and form a small bubble. This bubble effectively insulates the area; the bubble remains constant in size and sticks to the metal preventing a small spot from becoming anodized. This shows up as a shiny bright spot if the parts are dyed black.

To prevent "spotting" of anodized aluminum parts, they are often impregnated twice, before anodizing and dyeing, and again afterward to "fill" any further porosity which may have been opened up (or temporarily blocked off) by anodizing solution.

It is recommended that the impregnation of magnesium be performed after dichromate protection, so that all microporosity that is "smeared shut" during machining operations will be effectively filled. (See military specification MIL-I-7878, paragraph 3.3.3.)

Proper impregnation is particularly valuable in prevention of plating failures. Porous areas have a tendency to absorb plating and cleaning solutions; these exude and "spot out" after the plating cycle is complete. Impregnating before plating seals each pore with a dielectric material which not only prevents the platers' solutions from becoming entrapped, but does not allow an electrolytic "circle" to start in the pore.

In a similar manner, proper impregnation prevents failure of organic coatings on castings. Coats

Continued next page

THE FINISHING TOUCH

FINISHING OF ALUMINUM AND ZINC BASE DIE CASTINGS

by D. J. Swaninger
Sales Manager— Stevens Compositions

Each year, during the past decade, the use of zinc base and aluminum die castings has been on the ascendancy. Increased uses have been particularly noted in the automotive, aircraft, appliance, plumbing and radio-television industries.

New finishing techniques have played no small part in the rapid up-surge of die castings usage. The fine detail obtainable makes die castings ideal for decorative hardware and trim.

There are many finishing methods for aluminum or zinc base die castings. The choice is dependent upon final use of the individual part or product.

Typical die cast buffing operation on Stevens lathe.

For aluminum there is polishing, buffing, coloring, scratch-brushing, satin finishing, tumbling, etching, anodizing, bright dipping and electroplating.

For zinc polishing, buffing, tumbling and electroplating methods are used.

Which is best for you? Which will give the finish needed to make your product more saleable at the lowest cost to you?

Frederic B. Stevens, Inc., with their years of experience, can recommend the correct finishing procedure and furnish the equipment and supplies needed for the finishing of aluminum or zinc base die castings. Whether it is chemicals,

Stevens Model B Copper, Nickel, Chrome Die Cast Plating Machine.

compositions, lathes, automatic polishing equipment, Roto-Finish equipment or completely automatic electroplating and finishing machines, Stevens has it.

Perhaps we can help you with a Stevens L. V.* report. Write us on your company letterhead describing your product, the finish desired and required production.

*Laboratory Verified.

See the Stevens exhibit at the 4th Industrial Finishing Exposition, Cleveland, June 20 to 23. Booth No. 112.

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Impregnation Method—Cont.

of paint will often blister during the baking or curing cycle because entrapped air in the pores underlying the paint film will expand. Obviously, filling the pores with a solid inert material will prevent this type of failure. Also, since no solvents or other free agents are present in the impregnant, it is quite compatible with all paints.

Thus, casting impregnation using improved polyester-type resins enables aircraft component designers to specify castings for applications where other production techniques would merely be a poor substitute. In addition, the designer is not limited in choice of metal or casting technique; he can select magnesium, aluminum, zinc or copper-base die castings or he can specify ferrous or nonferrous sand, permanent mold or shell mold castings. Today, many manufacturers impregnate all aircraft cast components on a routine basis whether or not they must be pressure tight.

TAMMS ADDS REPRESENTATIVES

The Raw Materials Division of Tamms Industries, Inc., of Chicago, has recently appointed new representatives in the following areas: Mr. Robert Chenoweth, 531 Esperson Bldg., Houston 2, Texas; Victor Roberson Co., 4515 Olive Street, St. Louis 8, Missouri; Russell & Palmer Co., P.O. Box 2674 Custom House Station, New Orleans, Louisiana; Robert F. Sheahan Co., Suite 728 M & M Bldg., Memphis 2, Tennessee.

COATED ABRASIVES FILM ISSUED BY BEHR-MANNING

"Coated Abrasives Belts Speed Metalworking Production" is a sound-and-color close-up (104 application scenes) of the newest finishing developments in the fast moving coated abrasives technology. The methods, machinery and product applications shown will give the viewer an up-to-date problem and solution session aimed at cutting finishing cost.

Applications range from offhand contour and standard lathe work but concentrate mostly on semi-automatic and automatic operations. Work materials include ferrous, non-ferrous and nonmetallic; shapes include contour, cylindrical, flat and sheet products.

Film prints (16 mm, sound, color, 27-minutes) are available to foremen groups, plant production training classes, technical societies and college engineering and trade school groups, on application to: Dept. FI, Behr-Manning Division, Norton Company, Troy, N.Y.

HOW TO RUN A LATHE; published by the South Bend Lathe Works, South Bend, Ind.; $1.50.

This is the 53rd edition of what has become a standard work on lathe operation. The current edition has 128 pages and some 365 illustrations. The eleven chapters are clearly written in nontechnical language making it easy for the beginner to understand. Such items as installation and leveling of the lathe, grinding cutter bits, turning, boring, thread cutting, taper turning, etc. are covered.

HOW TO USE PORTABLE POWER TOOLS, by Maurice Reid; published by the Porter-Cable Co., Syracuse, N.Y.; $2.95.

In view of the recent rapid trend toward mechanization of all hand labor, the book is designed as an up-to-the-minute manual for the building and construction trades, maintenance crews, industrial production, wood and metal working shops. It describes all types of standard portable electric tools, newly developed machines, and numerous attachments for specialized jobs.

Step-by-step instructions on uses and "tricks of the trade" are included.

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USEFUL LITERATURE CATALOGS, MANUALS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PROCESSES

The Properties of Investment Castings: 144
A comprehensive 15-page booklet has been issued by the Crucible Steel Co. of America on the investment casting process. Covered are design, manufacture, alloys, cost, etc. Three pages of tabulated physical properties are especially valuable for the designer.

Shell Molding News Bulletin: 145
The Durez Plastics & Chemicals, Inc. issues the Durez Shell Molding News; a publication devoted to news about and information on the shell molding process and equipment and supplies for the process.

Castings for Industry: 146
The American Brake Shoe Co. has issued a new eight-page folder describing ABSCO metal castings. Five general engineering types of metal and several heat and wear resistant types are discussed. Physicals, mechanical properties and chemistry are given.

Non-ferrous Metal Powders: 147
The uses and applications of brass and other non-ferrous metal powders are given in a new publication of the New Jersey Zinc Co. The bulletin gives information on size ranges, shapes, strength, tolerances, etc. of parts made from these powders.

Dies, Die Castings, Etc.: 148
The facilities and experience of the Stemac Co. in the production of dies, die castings, engravings, stamps, name plates, etc. are described in a brochure that has been published recently.

Aluminum Bronze Permanent Mold Castings: 149
A new 32-page catalog issued by Alcaloy, Inc., describes some uses of their special aluminum bronze alloy. The company's jobbing facilities for producing permanent mold castings in this alloy are also presented. Features of the alloy are: high strength, non-sparking, non-magnetic and corrosion resistance.

MATERIALS AND EQUIPMENT

Direct Flow Pumps: 152
Using two-color photographs and line drawings to illustrate pump construction and operation, a new bulletin from the Aldrich Pump Co. fully describes the line of direct flow pumps for service from 390 to 20,700 psi and displacements from 2.08 to 109.6 gpm.

High Speed Rotary Hand Tools: 153
A thoroughly illustrated 18-page descriptive catalog of hand-held rotary power tools has been issued by Precise Products Corp. The several different models and the many different uses of the tool are described and illustrated. A price list is included.

Die Casting Machine: 154
The model 200 die casting machine built by Cleveland Automatic Machine Co. features 200 ton locking pressure and up to 18,000 psi pressure on the metal. The machine is fully described in a new bulletin just issued.

Fire-Resistant Hydraulic Fluids: 155
An all new 19-page bulletin has been published by Monsanto Chemical Co. describing fire-resistant hydraulic fluids in general and giving specific data on the properties and applications of Pydraul F-9.

Fluxes for Non-Ferrous Foundry Use: 156
A descriptive brochure, specially for foundry superintendents and engineers charged with melting and pouring metal, has been issued by the Rossborough Supply Co. The action of fluxes and the most applicable material for any molten metal or alloy are discussed.

Die Making Tools: 157
A power-driven hand tool for die makers, for scraping, honing, milling, filling, etc. is fully described and illustrated in a new brochure issued by Nord International Corp.

Four Small Die Casting Machines: 158
Specifications and design details of four small-size die casting machines, two hot chamber and two cold chamber, are given in a folder from DCMT Sales Corp. Casting capacities range from 2½ to 16 oz.; locking pressure of 12,000 and 24,000 psi; and injection pressures of 1680 and 2300 psi.

Combustion Equipment and Safeguards: 159
Two new bulletins have just been issued by Minneapolis-Honeywell Regulator Co. on controls and combustion safeguards for gas, oil and dual-fuel combustion equipment.

Thermocouple and Pyrometer Supplies: 160
The Bristol Co. has issued a new edition of their 56-page catalog on thermocouples and pyrometer accessories. The bulletin is virtually a buyers' guide and users' manual; it contains essential data on temperature measurement in a variety of industries.

Die Casting Machines: 161
A four-page brochure describing two models of 600-ton and one model of 900-ton locking pressure die casting machines has been published by Midwest Mechine Co., Inc. The several new features of these machines are described.

Equipment For Drilling Holes: 162
Two types of automatic equipment are offered by The General Pacific Corp. in a leaflet on hole drilling equipment: an automatic drill feed and an automatic deep hole driller. Equipment is useful for drilling, tapping, fly cutting, spinning, reaming, threading, spot facing, counterboring, hollow milling and skip drilling.

Medium Temperature Ovens: 163
Industrial ovens of a wide range of style and applications are described in Bulletin 10-S from Young Brothers Co. Temperatures up to 600F are possible with these ovens.

Molybdenum Processing, Properties: 164
The Tungsten and Chemical Div. of Sylvania Electric Products, Inc. has issued a thoroughly informative 20-page brochure on the properties and processing of molybdenum and some of the products made from the metal.

Lubrication Chart: 165
A wall chart containing lubrication recommendations for many industrial needs is now available from E. F. Houghton & Co. The chart covers such applications as hydraulic systems, spindles, air compressors, reduction gears etc.

Mechanized Furnaces: 166
Standard rated furnaces with a variety of mechanisms available for work handling are described in a brochure from Surface Combustion Corp. Straight through, push-pull, roller hearth, mesh belt, etc. are described.

Continued on next page

WHAT'S THE FASTEST WAY TO CLEAN METAL?
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9
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USEFUL LITERATURE—Cont.

High-Frequency Melting Furnaces: 167
Three informative booklets have been issued by Ajax Electrothermic Corp. on melting furnaces for both ferrous and non-ferrous metals. Ajax converter type induction furnaces are also described.

Die Cast Fasteners: 168
Gries Reproducer Corp. has issued a bulletin describing and illustrating some of the many die cast fastening devices made by that company in zinc alloy.

Industrial Instruments & Equipment: 169
A composite catalog listing and briefly describing the industrial instruments and accessory equipment manufactured by the Brown Instrument Div. of Minneapolis-Honeywell Regulator Co. has been issued.

Precision Dowel Pins: 170
Stock sizes of dowel pins from 0.016 dia. in steps of 1/64" and lengths from ⅛" in steps of 1/32", 1/16" and ¼" are listed in a new stock list that has been issued by All-Design Screw Mfg. Co., Inc.

FINISHING

Phosphate Coatings on Steel: 172
A new booklet has been issued by Oakite Products, Inc. entitled "How to Apply Iron Phosphate Coatings to Steel in Preparation for Painting". This 12-page booklet points out how the method of application is reflected in the quality of the finish secured.

Welding Aluminum & Its Alloys: 173
The production of stronger, more uniform resistance welds on aluminum and aluminum alloys is discussed in a new report that has been published by the Diversey Corp. Using the process described, welds with greater shear strength are said to be obtained with increased tip life.

Galvanizing with a Paint Brush: 174
A group of technical data sheets and descriptive material has been issued by Haldar Sales & Co. describing a new zinc coating to be applied to rusted steel. Protection equal to hot dip galvanizing is claimed.

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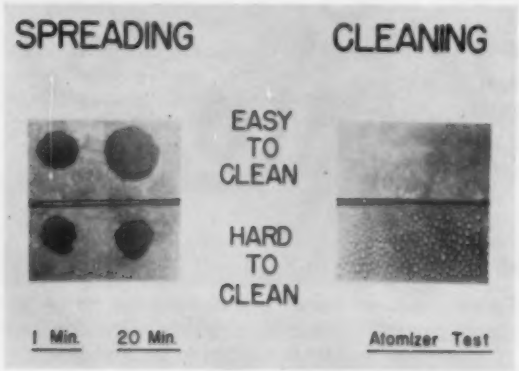
THE FINISHING TOUCH

EASY OR HARD TO CLEAN? You can tell in a hurry with the simple test shown below. The spreading rate of an oil on metal can now be used to predict how difficult the oil will be to remove. The test is of particular value to metal fabricators, electroplaters and other metal finishers who usually use oils of unknown chemistry. These oils, while essential to metal working and corrosion prevention, must be removed before painting or electroplating.

According to Professor Henry B. Linford of Columbia University, it is not necessary to know the composition of oils used for lubrication, cutting aid or rust protection in order to tell how hard it will be to clean a metal. The user will now be able to test an oil by watching how fast a drop spreads over a clean sample of the metal.

Laboratory work on metal cleaning, sponsored by the American Electroplaters' Society, discovered evidence that such a relationship might exist. Further work by Columbia has very definitely developed the relationship between ease of oil removal and its spreading rate. The rate for any oil was found to depend on the roughness and the kind of metal being used.



HERE'S HOW IT WORKS:

LEFT PANEL — Bottom half metal sheet shows how spreading rate is reduced for an oil which bonds tenaciously to metal surface — making removal difficult. Top half shows spreading rate with equal size drop different type oil.

RIGHT PANEL — Top and bottom halves of metal sheet were covered with same oils as in left panel — given mild cleaning and then inspected by the atomizer test. The droplets of water show where any residual oil film remains.

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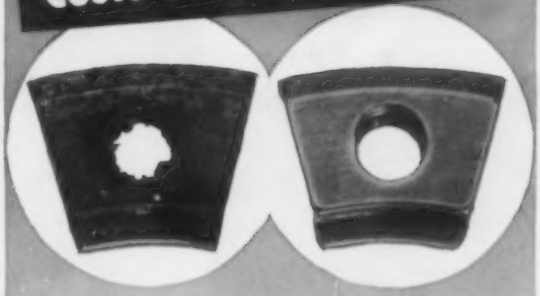

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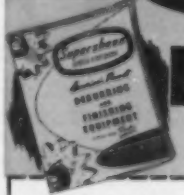

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PRODUCT NEWS AND DEVELOPMENTS

LOW COST BARREL FINISHING MACHINE

A new, low cost barrel finishing machine which incorporates many features of the company's deluxe models has recently been introduced.

The machine has all moving parts enclosed. Safety features include a pivot-mounted gate which closes when the machine is in operation, and a magnetic brake.

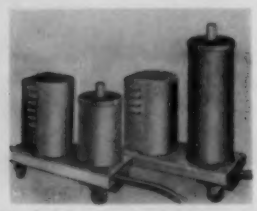
All lubrication points are readily accessible, since the motor, speed reducer, speed changer and brake are mounted in a single unit at the rear. The cylinder can be removed without disassembling the machine.

The unit has a steel frame, with oversize pillow blocks and self-aligning bearings which are capable of carrying full loads of steel burnishing media, the company says.

All controls are front mounted at working height. In addition there is a large amount of space underneath the barrel to facilitate rapid unloading.

Minnesota Mining & Mfg. Co.
For more information, circle No. 196 on the Reader Service Card

FILTERS PLATING SOLUTION AGAINST BACK PRESSURE



A new activated carbon type of alkaline plating solution filter has recently been introduced. The manufacturer says that through the use of a Mayno pump the filter delivers up to 75 percent of rated capacity against a back pressure of 50 psi. When the back pressure exceeds this amount the machine automatically signals that the filter tubes should be changed.

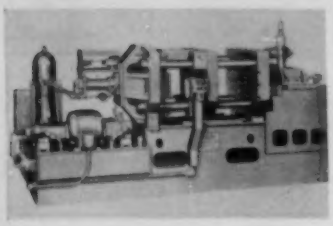
Two lines of the new filters are offered; one with a capacity of 100 to 150 gallons of activated carbon treated solution between changes; the larger unit from 500 to 1000 gallons between tube changes.

The principle of the filter involves the use of filter tubes of special honeycomb construction providing depth filtration with minimum clogging effect.

All parts are stainless steel where they contact corrosive liquids. Chemically resistant fluid hose for coupling is standard.

Lea Manufacturing Co.
For more information, circle No. 197 on the Reader Service Card

DIE CASTING MACHINE HAS MORE POWER, SPEED



Redesign of one of their standard machines to give more power and higher speed of operation has been announced by a manufacturer of die casting machines.

The machine, a plunger gooseneck type for the production of zinc, lead or tin die castings, has been increased in overall weight to 24,000 pounds through the use of heavy 6" thick solid steel die plates, 4" dia. tie bars and a channel steel base.

The machine has die plates 44½" x 17-¾" and the 12" of die separation stroke permits deep draw castings to be produced.

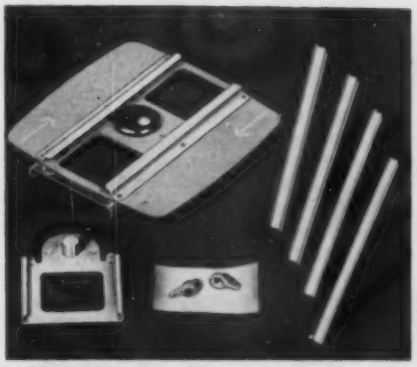
A completely new hydraulic system provides an extremely fast operating cycle through use of two single stage pumps mounted to a 15 HP double end motor, a system capable of putting the machine through a full 10 cycles per minute operating speed.

Kux Machine Co.
For more information, circle No. 198 on the Reader Service Card

Continued on page 64

SEE HOW YOU SAVE WHEN YOU SWITCH TO Honite BRAND

50% saving when manufacturer changes barrel finishing method



JUST A FEW of the 175 different kinds of parts Argus processes with HONITE Barrel Finishing Method.

Argus Cameras, Inc., Ann Arbor, Michigan, had been using barrel finishing since 1945—processing 175 different kinds of zinc, aluminum and steel camera parts such as those shown above. Last year HONITE Field Engineer D. J. Jones supervised a change to the HONITE Barrel Finishing Method.

Sample results? Recommended HONITE procedure helped cut finishing time on zinc die-cast levers from 36 hours to 15 hours—a time-saving of 58%. Costs of deburring and polishing aluminum camera-case castings were reduced from $.118 per unit to $.059.

Now—the company has found that the HONITE method cuts costs, increases production on intricate parts of all sizes. As many as 500,000 parts are processed weekly.

Your HONITE Field Engineer or nearby HONITE Distributor is a barrel finishing expert who can help *you* cut barrel finishing costs, too. Call him today!

Remember, too, the HONITE Division of the 3M Company supplies a *complete line* of abrasives, chips, compounds and equipment for every barrel finishing need. For complete information about HONITE products, write for free copy of booklet, "Facts and Figures Report on HONITE Barrel Finishing".

MINNESOTA MINING AND MFG. CO.
Dept. PM-55, St. Paul 6, Minn.

☐ Send me free copy of "Facts and Figures Report on HONITE Barrel Finishing"
☐ I'd like to talk with a HONITE Sales Engineer.

NAME..... TITLE.....

COMPANY.....

CITY..... ZONE... STATE.....

TYPE OF PRODUCTS TO BE FINISHED.....

Honite BRAND

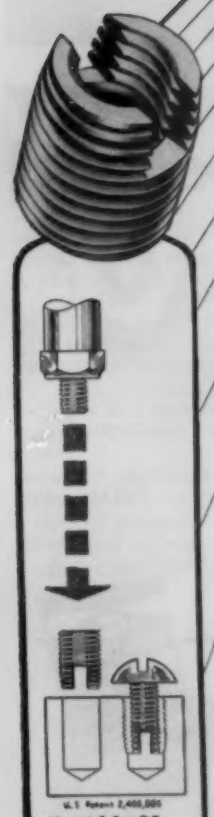
Made in U.S.A. by Minnesota Mining and Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: P. O. Box 757, London, Ontario. Export: 99 Park Ave., New York City. Makers of "SCOTCH" Pressure-sensitive Tapes, "SCOTCH" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing.

For more information circle No. 95 on the Reader Service Card

THREADED FASTENERS

need a firm grip, too!

Designers who use light metals, plastics and similar non-ferrous materials know that some kind of hard bushing is required as a foundation for tapped threads. That's why they specify TAP-LOK INSERTS*. These self-tapping hardened threaded bushings provide exceptionally rigid and vibration-proof anchorages for threaded fasteners in all materials. While primarily designed for original equipment installations, they are also used extensively for replacing stripped threads in salvage operations.



TAP-LOK INSERTS eliminate the troublesome failures of moulded inserts, and the production-line delays, because they are completely installed in one operation. Inserted with a simple driving tool, TAP-LOK INSERTS provide a perfect fit since they tap their own threads. They are held firmly in place by a friction lock that assures maximum torque-and-pull resistance.

Note these distinct* TAP-LOK *advantages:

1. **No hole preparation other than drilling.**
2. **INSERT taps its own thread.**
3. **Impossible to cross threads.**
4. **Friction locking, no secondary operation.**
5. **Easily installed by unskilled labor.**

U. S. Patent 2,405,505
*Reg. U. S. Pat. Off.

Send for descriptive folder

Also manufacturers of Groov-Pins for positive locking press fit.

GROOV-PIN

GROOV-PIN CORPORATION

1122 Hendricks Causeway Ridgefield, New Jersey

For more information circle No. 84 on the Reader Service Card

NEW PRODUCTS—Cont.

COLD DIP PLASTISOL
. . . resists abrasion, corrosion

A cold dip plastisol called compound 4129 that can be easily and economically applied has been introduced.

The new material is said to be formulated with the "flow" properties to be applied at greater speeds and in more practical thicknesses than other available cold dip plastisols.

With the new plastisols, it is possible to obtain dipping speeds of 17 to 18 inches per minute on automatic conveyor equipment, compared with speeds of 6 to 7 inches per minute on other materials available.

Another advantage claimed is that, for the same thickness of coating, approximately 50% less material is deposited. In spite of the lower material consumption the deposited film is said to maintain optimum film uniformity for longer service life.

The plastisol is applied at room temperature over a special primer which requires a short bake at about 350F. The coating is cured rapidly by baking at 350F to 365F for 20 to 30 minutes.

United Chromium, Inc.
For more information, circle No. 200 on the Reader Service Card

RUST PREVENTIVE
. . . for water hydraulic systems

A special lubricating and rust preventing additive has been developed for use in closed water hydraulic systems.

Called "Hydrolubric," this additive will provide lubrication throughout the entire hydraulic system. It is reported to prevent rust and pitting of metal surfaces; help reduce wear, power loss and water loss; increase packing life; aid pump and valve performance; and assure smoother operation of equipment.

E. F. Houghton & Co.
For more information, circle No. 201 on the Reader Service Card

NICKEL BATH
. . . for heavy deposits

A new nickel bath is now being used for the electroforming of nickel or nickel-face and copper body slush molds.

Designated the sulfamate nickel plating process, it has been engineered for electroforming and other heavy deposition applications. It deposits essentially

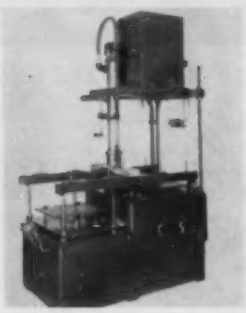
stress-free nickel from a low temperature bath at about four times the rate of conventional baths under similar working conditions.

The bath is said to be extremely simple from the standpoint of control and operating maintenance.

Barrett Chemical Products Co.
For more information, circle No. 199 on the Reader Service Card

SHELL MOLDS & CORES
. . . made on the same machine

The "Blo-Core" shell machine is reported to produce both shell molds and shell cores for shell mold casting separately or simultaneously. It can be operated both for high or limited production and is adaptable to small as well as large foundries. It takes



advantage of existing foundry equipment used in the shell mold process.

The machine is set for two station operation and requires only 24 sq. ft. of floor space. One unskilled operator can operate the machine from one position. Design of the machine is such that it is in constant production without waste operating time. The standard machine will accommodate patterns up to 15" x 20" and core boxes up to 36" high. It is adapted for either horizontal or vertical partings.

C & S Products Co.
For more information, circle No. 202 on the Reader Service Card

SMALL PUNCH PRESS
. . . for fast precision work

A new 15-ton punch press, has recently been announced, rounding out a line of small presses designed for fast, precision action, minimum downtime, and long service life.

Some construction features are: a solid one-piece alloy steel crankshaft, a pin diameter of 2-3/8", a 20" dia. 200 lb. flywheel carried on roller bearings. The ramways are V type to give precision guidance of the ram travel. The Bolster plate is 11" x 14".

The press is furnished in floor mounting only with either single or dual hand or foot operated controls.

Kenco Manufacturing Co.
For more information, circle No. 203 on the Reader Service Card

PICKLING MATERIAL
. . . acid detergent type

A new acid detergent type of compound designed for pickling and scale removal is said to remove light to moderate rust, heat scale, tarnish, and other oxides as well as normal shop dirt. It meets specification MIL-M-105-78A, Type III.

The new cleaner is a non-viscous, amber colored liquid product having a pH range of 1.5 to 1.0 at 70F and a bulk density of 11.0 lbs. per gallon. It is completely soluble in all proportions in water and alcohol and rinses easily in either hot or cold water. Recommended dilutions are in the range of 5 to 30% in water. The recommended operating temperature is 160F.

Oakite Products, Inc.
For more information, circle No. 204 on the Reader Service Card

SPRAY METALLIZING
. . . for finishing

Spray metallizing, for producing a hard, durable high lustre finish requires no treatment beyond a protective coating. Described as a substitute for more expensive plating methods, this type of process reaches down into the deepest intercises or un-

Continued next page

Why it pays to SPIN-DRY plated work— small lacquered parts

Choose from 3 carefully engineered models . . .

1. **Standard Model.** Takes nearly every type of part. Built for long, trouble-free service. J. I. C. and N. E. C. controls also available.

Saves time . . . With the New Holland Kreider Dryer operating at 625 r.p.m. on only ¾ h.p. you can *spin-dry* a basket of parts (1140 cu. ins.) in as little as 35 seconds—no more than 2 minutes.

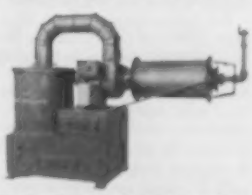
Improves quality. . . With a New Holland Kreider Dryer, high speed centrifugal spin-drying eliminates scarring and marring, assures smooth, evenly dried surfaces, with longer lasting luster . . . fewer "rejects."

Cuts costs . . . What's more, though a New Holland Kreider Dryer occupies less than 6 sq. ft. of floor space, it's a big money saver. Power costs are low, production high—with little or no maintenance over the years. And one man can operate it, easily, efficiently.

See for yourself. Write Department PM-5-500 today for illustrated 4-page folder.

New Holland Machine Co., New Holland, Pa.

2. **With Auxiliary Steam Heating Unit.** Used for small parts that hold moisture—lacquered parts—or where cold water rinse is used. Shown with J.I.C. control—N.E.C. control also available.



3. **With Auxiliary Gas Heating Unit.** Used for small parts. Caution: Do not use with inflammable materials.

NEW HOLLAND KREIDER DRYER

For more information circle No. 97 on the Reader Service Card

dercuts, without polishing.

The resulting top coat from spray metallizing may be left clear with a silver-chromium appearance, or dyed gold, brass, copper, or other suitable colors.

The process requires only seconds and can be operated either automatically or manually with unskilled labor. There are no limitations as to size, shape, or weight of items which can be processed.

Jems Chemical & Supply Co.
For more information, circle No. 205 on the Reader Service Card

CONVEYOR BELT
. . . features side chain

A newly designed side chain for use with hinged-steel conveyor. The new chain is available in 2½, 6 and 9 inch pitches with working loads per strand from 1250 lbs. for the 2½ in. up to 6750 lbs. for the 9 in. pitch size.

The new side chain is particularly designed to give increased performance for hinged-steel scrap conveyors, but can be utilized to advantage on other types of conveyors including slat or apron types as well as drag and open chain conveyors.

The side bars in each size can be furnished with a variety of roller diameters in flat or flanged design. The design of the side chain is such that it has the lowest possible coefficient of friction. With a 9 in. pitch chain and a working load of 6750 lbs. per strand, conveyor installations up to 1500 ft. long can be installed.

May-Fran Engineering, Inc.
For more information, circle No. 206 on the Reader Service Card

SHELL MOLD MACHINE
. . . has 1½ minute cycle

A new machine for making shell molds has been announced that will make a complete mold, cope and drag, in 1½ minutes when the two parts are on separate pattern plates or a complete mold in

1 min. when both cope and drag are on the same plate with a cracking rib in the center.

Three standard machines are made to handle plates 14 x 18, 13 x 24, or 20 x 30 inches. Machines for other sizes are produced to specification.

The machine is fully automatic. After a pattern plate is installed, pushing a button starts the machine through its cycle to produce shells automatically. High speed production of shells with minimum machine wear and low labor costs are claimed.

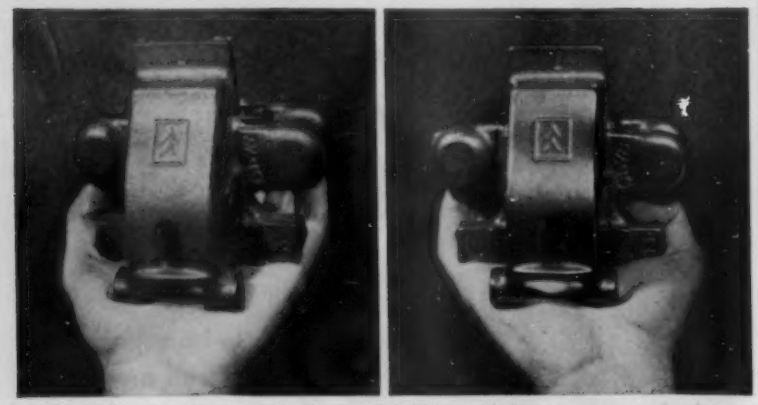
Tyler Metal Products Co.
For more information, circle No. 207 on the Reader Service Card

SANDING DISC
. . . removes metal faster

By incorporating spiral grooves in the face of a sanding disc, the rate of metal removal is said to be increased as much as 12 times when compared with a disc without the spiral grooving.

In addition to providing a self cleaning device, the grooves serve to direct the metal dust away from the operator and onto the floor so that the amount of dust in the air is lessened. Lack of build-up or loading in the disc allows the use of finer grits: a 24 grit spiral disc is said to do the same job of metal removal as a standard 16 grit and leave a smoother surface. With an 80 grit spiral wheel, hand filing, to produce a finished surface, is unnecessary.

National Gas Equipment Co.
For more information, circle No. 208 on the Reader Service Card



Identical castings, before and after barrel finishing with Norton ALUNDUM abrasive. Completely finishing this irregularly shaped part by hand would have taken much longer, with less uniform finishing of the many hard-to-reach spots.

ALUNDUM* tumbling abrasive tames another tough one!

Intricate parts finished faster, more thoroughly, when Norton abrasive adds the "TOUCH of GOLD"

The trickier, more intricate the parts, the easier it is to see the many advantages of barrel finishing with ALUNDUM tumbling abrasive. Hand finishing the casting illustrated, for example, would have been a long, tiresome chore — and an uneven job at best, due to the many irregularities of shape.

For parts ranging from even heftier castings down to tiny needles, there's nothing like ALUNDUM abrasive to bring out *all* the benefits of barrel finishing. This typical Norton abrasive development is sharp, dense, hard and non-fracturing. Its blocky shape eliminates slivers and chips in the tumbling process. In your tumbling barrels it assures:

- *Highest uniformity of radii and surfaces, with brightest, smoothest finish.*
- *Continual savings of man-hours, by reducing tumbling cycles, scrap and reworking to minimum.*

See Your Norton Distributor

for further facts on how ALUNDUM abrasive can add the time-saving, profit-boosting "Touch of Gold" to your finishing operations. Ask him for the new 55-page booklet on barrel finishing. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. 6 355

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON — *Making better products... to make your products better*

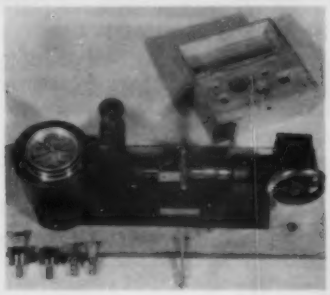
and its BEHR-MANNING division

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

For more information circle No. 96 on the Reader Service Card

PORTABLE TESTING MACHINE
. . . for powder compacts

A new portable testing machine has been developed for production or laboratory use. Through the proper choice of tooling, transverse rupture strength of a stand-



ard test bar can be read directly, or production parts can be tested for crushing or rupture strength.

Each machine is furnished with a standard set of tools that allows direct testing of bushings according to MPA standard procedures, transverse rupture tests also according to MPA standards and direct comparative testing of gear tooth strength and similar parts.

Operation of the testing machine is sufficiently rapid and simple so that it can be used as an inspection tool and is particularly valuable where statistical methods of quality control are used.

Depending upon the test to be made, the proper tools are fitted into the head and tail stocks and pressure applied through the hand wheel in the tail stock. The head stock work holder is connected directly to a cylinder which transmits pressure directly to the dial.

Heller, Inc.
For more information, circle No. 211 on the Reader Service Card

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INDUSTRIAL FILTER
. . . has greater capacity

By redesigning an automatic filter for all types of industrial filtration, the capacity of the unit has been materially increased without increasing its size.

The increase comes from elimination of tuning rods, giving an enlarged filtering area. The filter drum is divided into eight segments and cake on the loaded section is discharged by air pressure into the exit chute.

Rotation of the drum is controlled by a float that will automatically rotate the drum whenever a filter section becomes loaded with cake.

With the new design, filtering area is increased about 15 percent.

Murray-Way Corp.
For more information, circle No. 209 on the Reader Service Card

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DEGASSING CHAMBER
. . . for molten metal

Where the advantages of vacuum degassed metal are needed but standard vacuum melting equipment can not be installed, a vacuum degassing unit is now available that is said to greatly improve metal quality while holding installation costs down.

The new unit consists of a degassing chamber with associated evacuating equipment. Metal is melted in the usual manner but before pouring the crucible is placed in the degassing chamber and the pressure reduced. Most dissolved gases are removed by this treatment. Pouring is done then in the usual manner.

According to the manufacturers, there is only minimal gas pick-up during pouring so that castings or ingots are essentially as if vacuum melted and poured.

The Centrifugal Casting Machine Co.
For more information, circle No. 210 on the Reader Service Card

Continued next page

it's the finish that counts!

Roto-Finish maintains exact tolerances on precision parts with no significant dimensional changes. It makes possible a wide range of finishes applicable to parts of almost any size or shape; finishes a variety of materials — at big savings in manpower and costs. Without obligation, send sample unfinished parts to us. Include finished part for guide and your specifications. Roto-Finish will finish parts in its laboratory. You get a complete process report. You are guaranteed results and a finish that counts!

WRITE FOR FACT-PACKED ROTO-FINISH CATALOG NOW

Roto-Finish COMPANY

3716 Milham Road, Kalamazoo, Michigan
Originators of the Roto-Finish Process

P. O. Box 988
Phone 3-5578

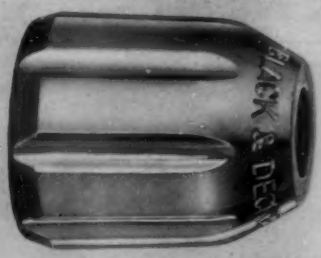
For more information circle No. 101 on the Reader Service Card

now

you can get this brilliant finish directly on zinc die castings!

No electroplating--no mechanical finishing!

PART AS CAST



TREATED WITH NEW IRIDITE

NEW IRIDITE (Cast-Zinc-Brite)

brightens zinc die castings by chemical polishing, protects against corrosion

NOW, FOR THE FIRST TIME you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for FREE PROCESSING for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. *IMPORTANT: when you give us samples for test processing, please be sure to identify the alloy used.*

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals and ASP Plating Chemicals

For more information circle No. 81 on the Reader Service Card

CUT-OFF PLATING SWITCH . . . improves barrel plating operations

A new device has been offered to make barrel plating safer, speed up production, save plating time and material.

An automatic cut-off plating switch, automatically terminates current flow in barrel plating systems after sufficient deposits have been made on the parts being plated.

A cut-off switch is mounted at each tank. At the start of the plating operation the automatic timer is pre-set and allows current flow for as long as desired. At the end of the pre-set time, the current is shut off at the barrel and a red light turns on, indicating that the plating cycle is completed.

Thus, plating time is made accurate because error, guessing, forgetfulness and confusion have been eliminated. Excessive overplating is prevented and costly time and materials are saved. With the new control, supervisory personnel can more easily check on operations.

Hoffman Plating Co.
For more information, circle No. 212 on the Reader Service Card

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CARTRIDGE TYPE FILTER UNITS . . . for electroplating

Announcement has been made of the design, manufacture and sale of a new series of cartridge type filter units designed specifically for the electroplating and electroforming industries.

The units are available in a variety of models ranging from 100 gallons to 5,000 gallons or more per hour. They are available in iron, stainless steel, rubber and plastic for use with all types of corrosive solutions. The units are easy to assemble and disassemble.

Cartridges are woven in a variety of fabrics including cotton, dynel, orlon, glass, acetate and nylon.

Comco, Inc., Div. of Enthone, Inc.
For more information, circle No. 213 on the Reader Service Card

UNICHROME
Trade Mark

News about
COATINGS for METALS
Metallic..... Organic..... Decorative..... Protective

Copper Plating Fit for Die Castings

Non-cyanide Unichrome Copper delivers operating features of special interest to die casters

Ready for direct bright nickel plating, this die casting shows the typically lustrous copper plate from Unichrome Copper. Courtesy Royal Plating and Polishing Co., Inc., Newark, N. J.

There are definite differences to be seen in both the deposits and the operation of different copper plating solutions.

In the case of the Unichrome Pyrophosphate Copper Process, the differences are of direct benefit to plants plating die castings.

SMOOTHNESS IS BASIC

Unichrome Copper deposits are noted for their essential smoothness and uniformity when plated over a wide current density range.

Since the solution also is nearly neutral in pH, it is well suited for plating light metal castings. Of the alkaline copper solutions, Unichrome Copper has an advantage in its relative insensitivity to metals, organics, etc.

NO BUFFING

With newly perfected addition agents, a lustrous deposit is produced which proves ideal for direct plating with nickel. It needs neither buffing nor activation treatment.

The addition agents not only give even wider bright plate range than obtained with the basic bath, but also step up plating speed as much as 20%.

EXTRA BONUS

Disposal of cyanide wastes is a problem that can't be overlooked. But it can be minimized with non-cyanide Unichrome Pyrophosphate Copper. As one user recently put it, "a pyrophosphate-type copper solution was selected because of its wide brightness range and because it does not present a serious waste disposal problem."

MATCHED PLATING PROCESSES

Unichrome Copper is also part of a matched set of processes for better copper-nickel-chromium finishing. Its deposit is ideally receptive for Unichrome Bright Nickel, which in turn, is unusually receptive for chromium deposits and which works outstandingly well with Unichrome SRHS Chromium.

Send for details on all three processes.

United Chromium now provides plating equipment

Much time and money can today be saved in designing new plating facilities and in buying new equipment. United Chromium now plans and supplies equipment for general plating, offering the benefit of over 25 years close working experience with plating plants.

Already several complete installations have been made by United Chromium, and have included plating and cleaning tanks, rectifiers, heaters, blowers, anodes and the like. By working with United Chromium, these plants assured equipment designed for efficiency and economy.

EXAMPLE OF ECONOMY

Unichrome Tantalum Heating and Cooling Coils are not just acid-resistant but actually acidproof to all common plating acids except hydrofluoric. Outlasting lead by far, they often more than pay for themselves by minimizing downtime and maintenance.

EXAMPLE OF EFFICIENCY

Unichrome Round Anodes, an original United Chromium development, are active over their entire surfaces and distribute the current better. When they replaced "flats" in an automotive plant plating tank, they eliminated former need for costly weekly maintenance. They also plated better with less power, enabling a $29,000 standby generator to be switched to other work.

United Chromium will be glad to consult with you on your equipment requirements.

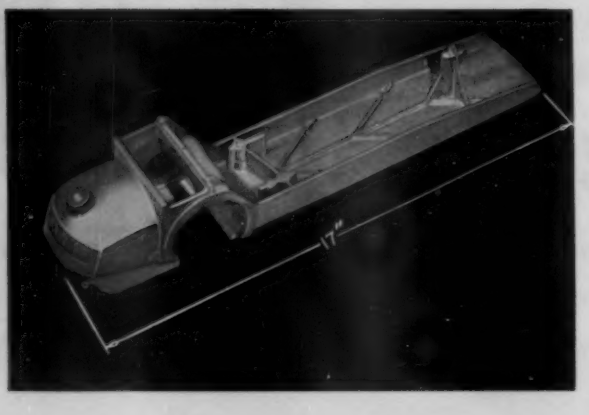
UNITED CHROMIUM, INCORPORATED

A Metal & Thermit Organization

100 East 42nd Street, New York 17, N. Y.
Waterbury 20, Conn. • Detroit 20, Mich.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada:
United Chromium Limited, Toronto 1, Ont.

For more information circle No. 31 on the Reader Service Card

An asset to your product . .



. . our precision die castings

FEDERAL DIE CASTING CO.
2220 N. ELSTON AVE. CHICAGO, 14, ILL.
PHONE ARmitage 6-4803

BARREL FINISHING AWARDS OFFERED BY ALMCO SUPERSHEEN

Almco Supersheen has annonuced a series of awards "For meritorious achievement in further advancing barrel finishing progress."

The awards will be made in two divisions: Division I for the largest total dollar savings from finishing a part or parts by Almco Supersheen Finishing as compared with former methods; Division II for the greatest percentage of saving from finishing a part by Supersheen finishing as compared to former methods.

In each division there will be three award periods during the year. Winning award will be $100.00 with a second place award of $50.00. Further, in each division there will be a yearly grand prize of $250.00.

Information as to who can enter, the rules and regulations, entry blanks, etc. can be secured from Almco Supersheen, Albert Lea, Minn.

GET MORE PRODUCTION AND SERVICE FOR YOUR DOLLAR with
Bonus Built
POWER PRESSES
JOHNSON
Rugged, dependable, time-tested Johnson presses have a reputation for adaptability. Versatility in a press earns extra income, for you can handle large jobs. All models available with key or Wichita LOW INERTIA clutch.
Write for Specification Bulletin 1955
Covering 20 Models 16 to 116 Tons Capacity
for SPEED POWER ACCURACY
the HYDRA-SHEAR
Increase your production to a new high. Shear mild steel up to 10 gauge in three lengths: 6, 8 and 10 ft. Less swel and burring. No gears or clutch.
Johnson
MACHINE and PRESS CORP.
620 W. INDIANA AVE. • ELKHART, INDIANA

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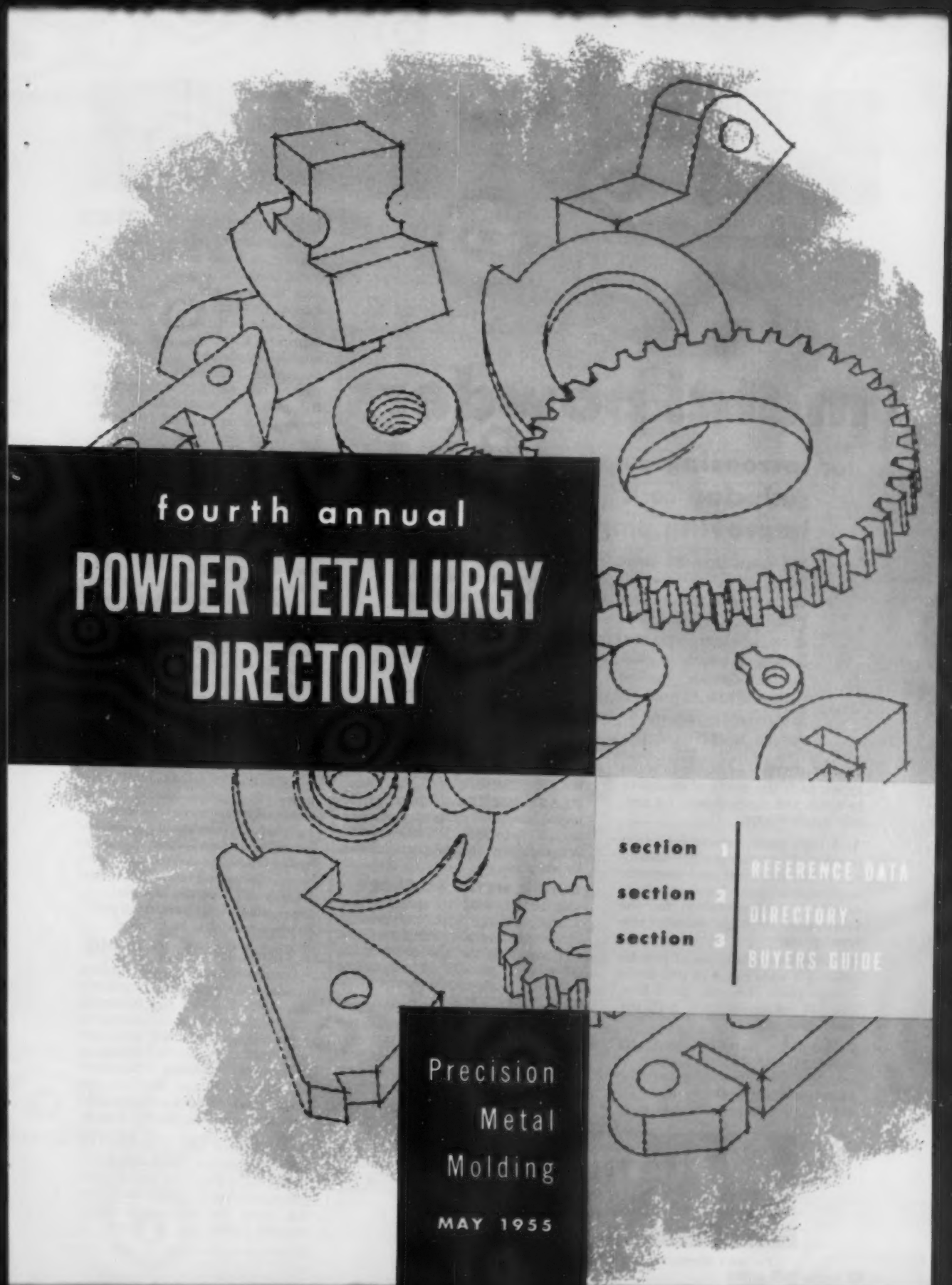


fourth annual

POWDER METALLURGY DIRECTORY

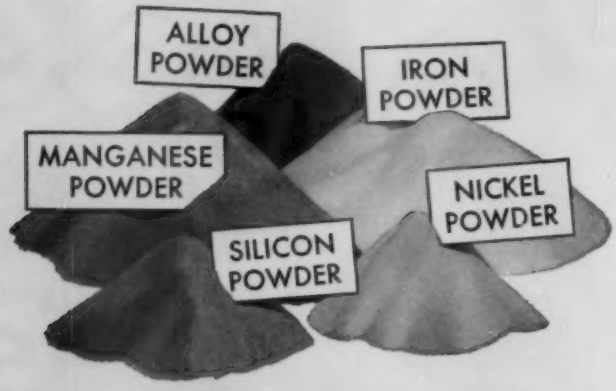
section 1 REFERENCE DATA

section 2 DIRECTORY

section 3 BUYERS GUIDE

Precision Metal Molding

MAY 1955



metal powders

for **increasing** output
reducing costs
improving product quality

For more than 20 years, Plastic Metals has served industry as its most dependable source of a wide variety of grades of iron powder. During this time, Plastic Metals has become the country's largest producer of electrolytic iron powder and has achieved a leading position in the production of other ferrous and non-ferrous powders.

Plastic Metals produces the following metal powders in standard grades and to customers' specifications with respect to chemical, physical, or magnetic properties:

PLAST-IRON—available in three types, each the result of extensive research and development for specific applications:

1. A high quality electrolytic iron powder of extreme purity—ideally suited for electrical and magnetic applications and, because of its excellent compressibility, for the fabrication of high density sintered parts.

2. Reduced oxide types of powder offering a wide range of properties—high green strength, good flow, unusual compressibility, high sintered strength, etc.

3. An iron powder specially developed for the production of television transformer cores with exceptional permeability and "Q" values in frequency range of 10 to 100 KC. It also has excellent compacting properties.

PLAST-NICKEL—a high grade nickel powder with purity ranging from 97% to 99%. Either spherical or irregularly shaped particles can be supplied.

OTHER METAL POWDERS—can be supplied to specification. Likewise, large scale pulverizing, screening and annealing facilities are available for the preparation of a wide variety of substances required in powdered form.

We will be glad to talk with you about metal powder possibilities and limitations—and to put you in touch with reliable and experienced metal powder fabricators for a practical discussion of your particular problems.

PLASTIC METALS
DIVISION OF THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PENNSYLVANIA

For more information circle No. 62 on the Reader Service Card

3rd annual
POWDER METALLURGY DIRECTORY

CONTENTS

1. Reference **73-83**

The reference tables of characteristics of metal powders, and of parts produced from metal powders, indicate only the *nominal* or *typical* properties of these materials obtained from the manufacturers listed on page 83. It must be emphasized that these are presented largely for their relative or comparative value among the particular materials or with respect to cast or solid materials. Hardness values, in particular, are only of value in a relative way because the porosity of powder metal materials prevents true evaluation by conventional tests.

Because of the nature of the powder metal process, different items made of the same material may exhibit an appreciable difference in properties, depending upon the size, shape, reaction to processing conditions, etc. In fact, different sections of the same piece may show some difference in properties. Therefore, each part must be considered and analyzed individually to assure satisfactory properties, not only in the part as a whole, but also in a particular section if it has critical requirements.

The data *should not be used for specification or inspection purposes.* The proper specifications, tests and inspection procedures for each specific item should be established and agreed upon mutually by the fabricator and the user. Under proper specifications, the uniformity of properties of a particular powder metal part, from piece to piece and lot to lot, is good.

2. Product Sources **85-106**

Companies are listed according to products manufactured or services offered under the following general headings: Components Fabricators, Equipment Builders, and Powder Suppliers. Listings of companies advertising in this issue appear in bold type. Refer to the index of advertisers on pages 123-124 for more complete details.

3. Alphabetical List **107-116**

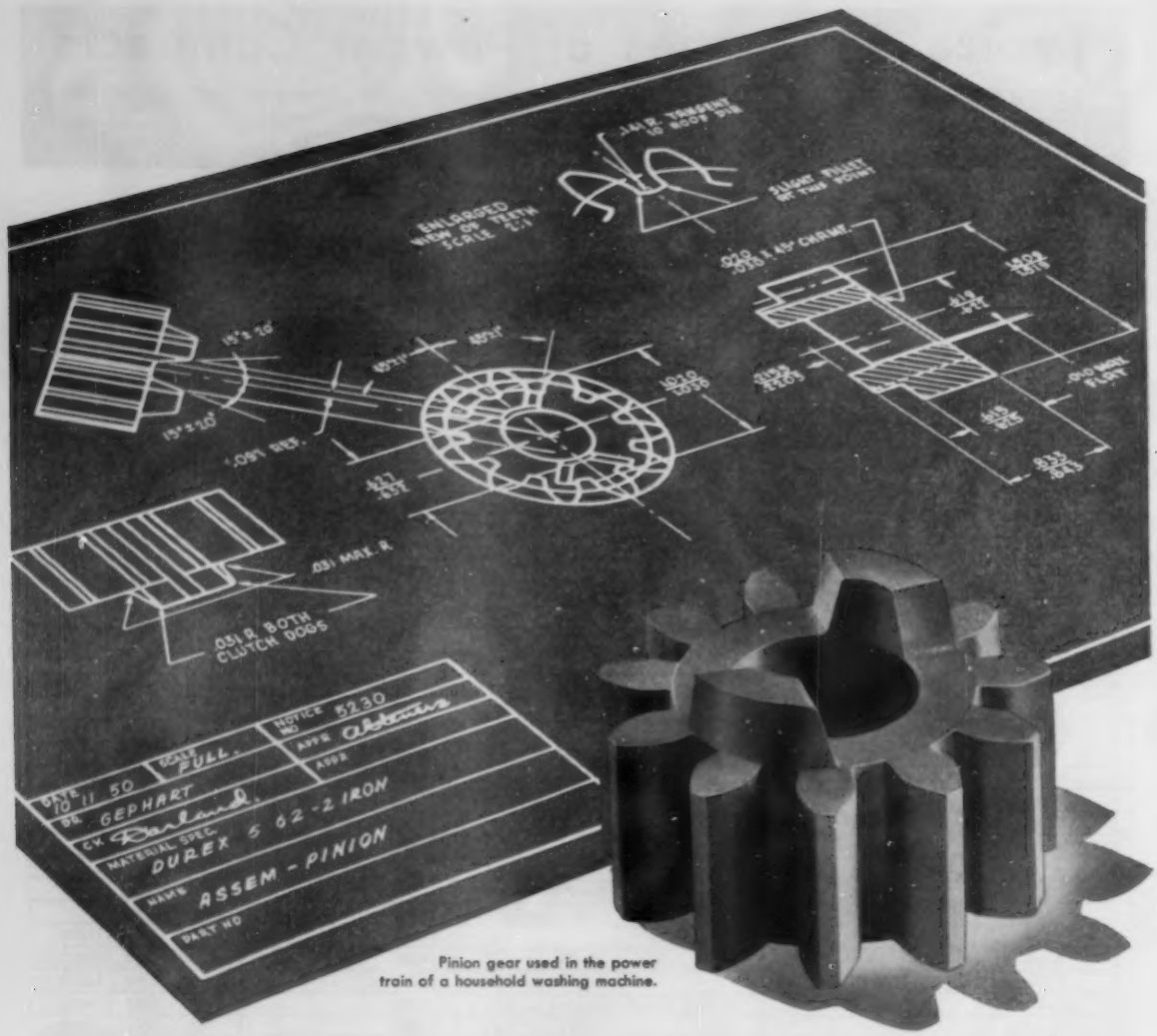
Companies are listed alphabetically within the three major categories referred to above. Each listing notes the company's major powder metallurgy products.

Typical Properties of Powder Compacts

COPPER BASE

Manufacturer		Composition							Density g/cc	Ultimate Tensile psi	Yield Strength psi	Elongation % in 1"	Rockwell Hardness	Yield in comp.*
Code No.	Designation	% Fe	% Cu	% C	% Sn	% Zn	% Ni	% Other						
1	H		89		9.75			1.25	6.6	14700			30-70H	32000
1	3-H		89		9.75			1.25	6.3	12000			25-50H	26000
1	R		87		9.5			3.5	6.6	15500			30-60H	37500
2	12		80			20			7.5	34100				
2	24		90-94		6-10				6.2	13000				
2	26		90-94		6-10				7.0	25000				
3	Z901		90			10			8.0	32000		18		
3	Z901P		90			10		.5P	7.9	30000		0.5		
3	Z851		85			15			7.85	35000		15		
3	Z802PB		80			20		1.5Pb	7.65	29000		7-12		
3	N6418		64			18	18		7.89	42000		14		
3	Z7030		70			30			7.6	35000		13		
3	B900		92		8				6.6	15000				
3	B901		90		10				6.6	18000				
3	B903		90		10				7.5	40000				
3	B904		92		8				7.2	25000				
4	B8501		69.5	1	9.5				6.4	12500				
4	B8502		90		10				6.6	14500		1.2	63H	
4	S8700		64			18	18		7.8	32000		10	84H	
4	S8400		78.5			20		1.5Pb	7.8	27000		10	85H	
5	P110S		88-92		8-12				6.2	14000	11000			
5	P110H		88-92		8-12				6.7	16500	15000			
5	2-101		90			10			7.9	28000	11000			
6	BR901		90		10				6.2	15000				13000
6	BZ901		90			10			8.0	26000				34000
6	BZ802		80			20			7.8	30000				
6	NS185		64			18	18		7.8	40000				
7	90		87.5	1.5	10.5			0.5	6.4-6.8	12000			25(1)	
7	Std.		83-87	1.5	9.5-10.5			2.0-4.0Pb	6.4-6.8	12000			25(1)	
7	FA		95.0	.5-2.0				3.0	5.8-6.2	15000		1.0	40(1)	
8	C-64		90		10				6.4	14000		2	53H	11000
8	E-183		82-88	1.75	9.5-10.5	.75	.35	2-4Pb	6.5	14000		2	53H	11000
8	D-692	25	65	(bal Zn. Sn., etc.)					6.2	16000		1	57H	14000
8	D-10-1		75			16 (bal. Graph., Sn. etc.)			6.7	10000		2	50H	6000
8	V-1		78.5			20		1.5Pb	7.5	21000		15	70H	12000
8	V-3		64			18	18		7.7	32000		10	92H	18000
9	4000		89	.5	10			.5	6.6-7.0	12000				
11	PC800		90		10				6.8	16000		5	30(1)	
11	PC826		87		9			4Pb	6.4	10000		4		
11	PC886		64			18	18		6.8	24000		6		
13	81		x	x	x				6.8	13000				
13	61		x		x				6.8	16800				
13	168		x	x	x			Pb	6.7	11200				
13	183		x		x		x	Pb	6.8	15000				
13	263		x		x		x		6.9	25000				
13	273		x			x	x		6.7	17000				
13	138		x						7.4	20100				
13	272		x			x			6.8	26000				
14	BZ3		90			10			7.0-7.3	15-17300		3.5-6.1	30-70H	
14	BZ4		85			15			7.3-7.6	16-20600		5.1-8.6	20-70H	
14	BZ5		78.5			20		1.5Pb	7.3-7.7	16-25900		5.2-9.1	25-80H	
14	BZ11		78.5			20		0-1Pb	7.3-7.6	17-27600		6.6-22.3	45-90H	
14	B50		90		10				6.9-7.1	14-16700		6.8-7.1	60-70H	
14	W55		90		10				7.7-8.3	19-33600		8.9-15.6	45H-25B	
14	W60		64			18	18		7.3-7.7	19-22700		2.8-4.6	65H-30B	
15	Oilite		Bal.		5	(Stressite Bronze)			7.3	20000		10		
15	Oilite		Bal.	(Brass)		20		1.5Pb	7.2	20000		10	45(1)	15000
15	Oilite		Bal.	(Nickel Silver)		18	18		7.2	14000		7	35(1)	
15	Oilite		100						8.0	20000		8		15000
15	Oilite		Bal.		10		(Bronze)		6.4	18000		10	40(1)	20000
16	1A		89.5	0.5	10				6.4-6.8	15000			30H	

*0.1% offset, psi. (Code numbers on page 83)



Pinion gear used in the power train of a household washing machine.

MORAINE METAL POWDER PARTS SOLVE MANY PRODUCTION PROBLEMS

Here you see a complex design that is being mass-produced today by metal powder techniques *with important savings in cost.*

The print in the background indicates the intricacy of the design, while the photograph in the foreground shows the part ready to be assembled into the final mechanism. And from raw material to what you see here took only *one press operation!* This demonstrates what has come to be expected through cooperation between customer and Moraine.

Moraine's experience with metal powder is called upon almost daily to resolve complex designs into economical production jobs—just as Moraine almost daily contributes to modern industry by improving product performance and lowering costs.

moraine products
DIVISION OF GENERAL MOTORS, DAYTON, OHIO

METAL POWDER PARTS

Typical Properties Of Metal Powders — Cont.

Manufacturer		Composition							Density g/cc	Ultimate Tensile psi	Yield Strength psi	Elongation % in 1"	Rockwell Hardness	Yield in comp.*
Code No.	Designation	% Fe	% Cu	% C	% Sn	% Zn	% Ni	% Other						

IRON BASE

1	61-P	90	10						6.1	30000			80-100H	81000(2)
1	55-P	95	5						5.5	12000			25-60H	37000
1	59-1	100							5.9	12000			30-60H	79000(2)
2	42	92	8						5.5	32000				
2	48	95	5						6.2	48000				
2	36	99		1					5.8	15000				
2	38	99		1					6.4	32000				
2	98	99							7.0					
2	75	80-90	10-20	(Infiltrated)						75000				
3	CI-100	98.9		1					6.4	30000				
3	S-200	97		1				2	6.7	70000				
3	L-1010	90	10	1					6.0	55000				
3	LI-1010	90		1				9	7.3	75000				
3	EC-100	99.5						.5	8.0	21000		9-12		
3	HDS	98		.85					7.6	100000		8		
3	1-1	98							7.7	135000		18		
3	1-2	90							7.7	81000		18		
3	1-3	98							7.5	105000		12		
4	S-6800	90	10						6.2	29000		0.9	55F	
4	S-6801	72	25					(Infiltrated)	7.4	60000		3	70B	
5	P-150S	92-98	2-8						5.4	16000				30000
5	P-150H	92-98	2-8						5.7	20000				36000
5	P-120	87-93	8-13						5.9	40000				50000
6	Fe901	90	10						5.9	40000				30000
6	Fe955	95	5						5.6	20000				30000
7	FB 5	Bal.	5.0					3.0	5.8-6.2	13000		1.3	30(1)	
7	FB10	Bal.	10.0					3.0	5.8-6.2	30000			45(1)	
7	FB20	Bal.	20.0					3.0	5.8-6.2	30000		1.0	45(1)	
8	F-101	99	1						6.1	16000		1	60H	22000
8	F-125	95	5						5.4	18000		0.5	75H	25000
8	F-200	90	10						5.8	30000		0.5	94H	32000
8	Z-3	75	25				(Infiltrated)		7.5	65000		1.5	75B	70000
8	Z-4C	100		(carburized and water quenched)					7.6	52800		1	48C	37600
8	IZ-4	100		(fully annealed condition)					7.4	43200		8.7	37B	23600
8	Z-4	100		(fully annealed condition)					7.6	45500		18.5	42B	25200
8	Z-2	Bal.		0.3			1.5	0.45Mn 0.20Mo	7.5	115000	85000	1.5	30C	80000
9	1000	99		0.5				0.5	5.7-6.1	15000				
9	1000D	99		0.5				0.5	6.1-7.3	20-50000				
9	1000Cu	85-90	10-15	0.5				0.5	7.2-7.6	60-100000				
9	1290	89	10	0.5				0.5	5.8-6.2	30000				
9	1295	94	5	0.5				0.5	5.8-6.2	40000				
10	41	90	9	0.7				Bal.	5.8	26000	25000	2.0	28B	40000
10	42	89	10	0.9				Bal.	6.2	40000	36000	2.0	34B	54000
10	X-14	78	20	0.8				Bal.	7.4	75000	69000	2.0	85B	70000
10	40	99		0.8				Bal.	5.8	26000	25000	2.5		37000
11	PC600	98.5		1.5					6.1	24000		1	60(1)	
11	PC626	97	3						6.1	25000			60(1)	
11	PC627	90	10						6.2	30000		1	90(1)	
11	PC628	85	15						6.2	32000		3	90(1)	
11	PC629	75	25		(copper impregnated)				6.2	34000		4	90(1)	
11	PC632	100							7.0	65000		7	140(1)	
12	1000	99.95						0.05	7-7.3	36200	24000	10		
12	2000	99.95						0.05	7.5	60000	55000	5		
12	3000	99.95						0.05	7.5	50000	30000	25		
12	4000	99.95		(carburized, light case)				0.05	7.3	78000		2		
12	4000	99.95		(carburized, light case)				0.05	7.0	95000		0		
12	5000	99.95		(carburized, light case)				0.05	7.5	70000		2-4		
12	6000	99.95		(carburized, heavy case)				0.05	7.5	200000		0-1	62C	
12	7000	99.95		(carburized, heavy case)				0.05	7.5	170000	165000	2-4		
13	167	x							6.0	16000				
13	78	x	x	x					6.0	29000				
13	249	x	x	x					6.1	37200				
13	230	x								17000				

*0.1% offset, psi. (Code numbers on page 83)

Specify HVA Electrolytic Iron Powder...

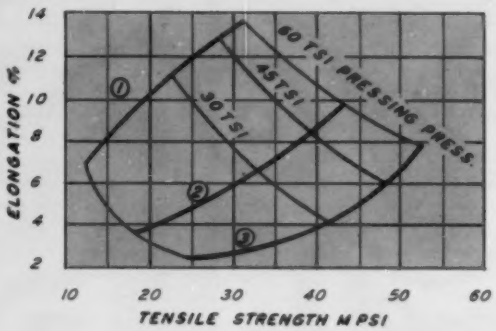
for The Right Combination of Tensile Strength, Elongation and Impact Strength

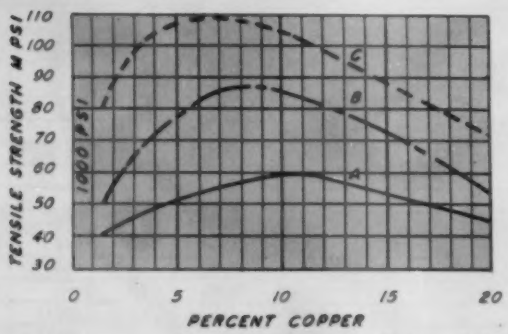
High purity HVA Electrolytic Iron Powder combines readily with small amounts of copper in a single pressing and sintering cycle. With .4% carbon maximum you get good strength without sacrificing elongation and toughness. This combination gives good impact strength without infiltrating large amounts of copper.

High Tensile Strength and Elongation . . .

. . . are obtained at reasonable pressing pressures by a single pressing and sintering for one hour at 2050 F. These curves show the advantages of low carbon content in copper alloys:

1. Straight HVA Electrolytic Iron (.25% carbon)
2. HVA Electrolytic Iron plus 3% Copper
3. HVA Electrolytic Iron plus 7% Copper





Higher Physicals . . .

. . . with minimum dimensional changes are obtained by heat treating to cause precipitation hardening of the iron-copper alloys (as shown in curve B). Properties approximating those of forgings are obtained by double pressing and hardening.

A. Single pressed and sintered.
B. Single pressed, sintered and heat treated.
C. Double pressed, double sintered and heat treated.

Want more specific information on your problems? The coupon below will bring you a copy of the HVA data book. Or we will send sintered slugs for you to machine into test parts. Then you can evaluate HVA high-strength powder metallurgy yourself.

A. JOHNSON & COMPANY, INC.
61 BROADWAY **NEW YORK CITY 6, N. Y.**

A. JOHNSON & CO., INC.
61 Broadway, New York City 6, N. Y.
Please send me, at no obligation to myself, the items checked:
☐ Details on your sintered slug service
☐ Copy of the HVA Data Book

Name .....
Title .....
Company .....
Street .....
City ..... State .....

For more information circle No. 106 on the Reader Service Card

Typical Properties Of Metal Powders — Cont.

Manufacturer		Composition							Density g/cc	Ultimate Tensile psi	Yield Strength psi	Elongation % in 1"	Rockwell Hardness	Yield in comp.*
Code No.	Designation	% Fe	% Cu	% C	% Sn	% Zn	% Ni	% Other						
BRASS														
13	277	x								18000				
13	266	x	x	x				Pb	6.0	24000				
13	86	x	x	x					6.0	34000				
14	E10	100							5.7-6.2	14-25500		2.8-5.7	70H-40B	
14	E66	100							6.4-6.8	21-28400		3.3-6.6	0-50B	
14	E70	100							6.9-7.7	33-80900		3.8-12.3	20-90B	
14	B27	93	7						5.3-5.8	18-32500		1.2-2.0	0-50B	
14	W30	93	7						5.8-6.2	23-35700		1.8-3.1	20-66B	
14	W40	93	7						6.2-6.8	49-66400		1.9-2.2	30-76B	
14	W63	80	20						6.4-6.8	27-44200		1.3-2.1	30H-10B	
14	W100	80	20	(Infiltrated)					7.6-8.2	66-100200		3.0-5.2	50-100B	
14	Z10	100		(carburized and quenched)					5.7-6.2	31-57200			60-62C	(3)
14	Z66	100		(carburized and quenched)					6.4-6.8	41-73100			60-62C	(3)
14	Z70	100		(carburized and quenched)					7.0-7.7	69-84300			60-62C	(3)
14	Z150	80	20	(carburized and quenched, infiltrated)					7.6-8.2	98-147800			60-62C	(3)
15	Oilite	100		(Steel)					7.0	35000		10	80(1)	24000
15	Oilite	Bal.	0.5	(Steel AC)					7.0	50000		5	140(1)	80000
15	Oilite	Bal.	0.5	(Steel AH)					7.0	120000		1	300(1)	150000
15	Oilite	Bal.	0.25-1.0	(Iron)					6.1	20-30000		.5-3	50(1)	30000
15	Oilite	Bal.		(Stainless Steel)			8	18Cr	6.4	40000		7	50(1)	45000
15	Oilite	Bal.	20	(Iron IM)				0.5	7.4	75000		1	83(1)	95000
15	Oilite	Bal.	7	(Super 9)					5.8	32000		0.5	60(1)	32000
15	Oilite	Bal.	25	(Super)					5.8	25000		1	45(1)	30000
15	Oilite	Bal.	20	(Super 16)				0.5	6.4	40000		1	140(1)	75000
16	II B	Bal.	10-15						5.8-6.2	30000			80H	
16	II B	Bal.	15-20						5.8-6.2	30000			70H	
16	II A	99							5.7-6.1	14000			30H	
16	7	74	25	(Infiltrated)					7.1-7.6	75000			65B	
16	7S	74	25	(Infiltrated and Carbonitrided)					7.1-7.6	80000			90B	

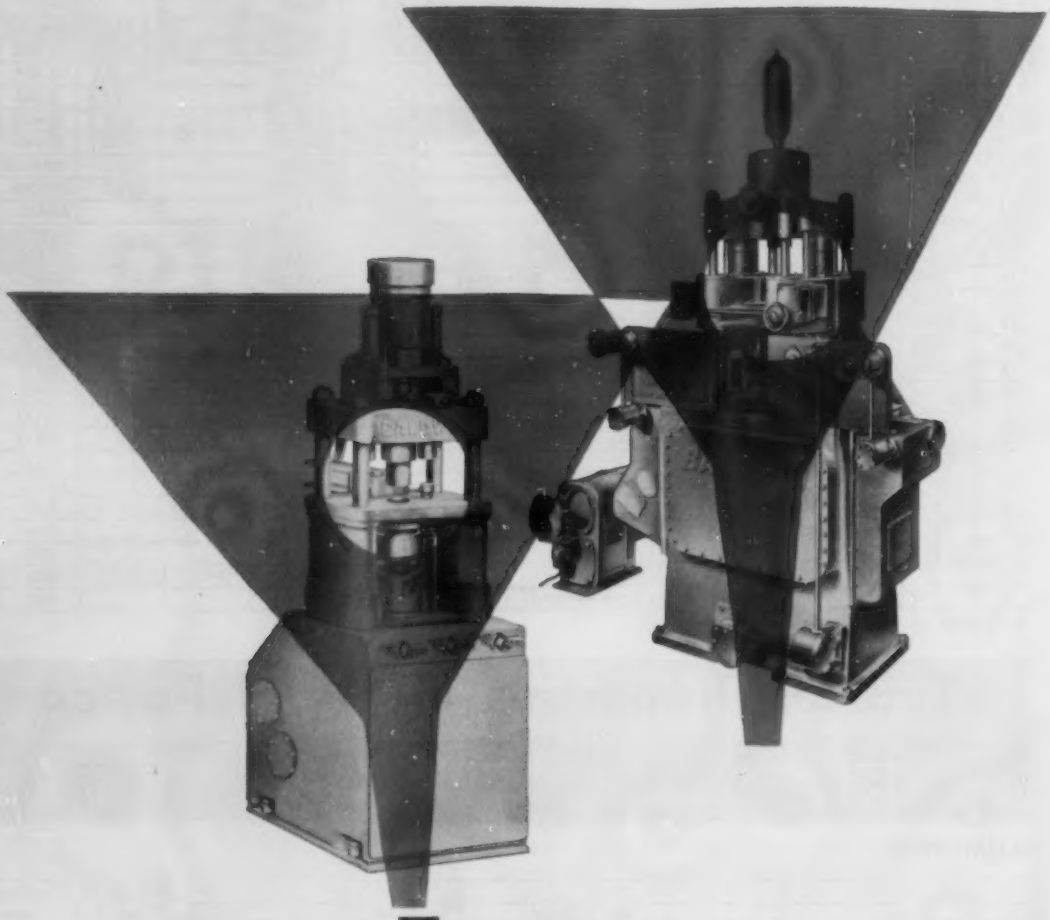
*0.1% offset, psi. (Code numbers on page 83)

Typical Properties of Metal Powders

Manufacturer		Composition						Hyd. Loss	App. Density*	Flowability**	Green Density†	Screen Analysis					
Code No.	Designation	% Fe	% Cu	% C	% Si	% Al	% Others					+ 100	− 100 + 150	− 150 + 200	− 200 + 250	− 250 + 325	− 325
ALUMINUM																	
11	13					99			1.00				20 mesh control screen				30.0
11	33					99			0.90				30 mesh control screen				35.0
11	44					99			0.90				40 mesh control screen				40.0
11	101					99			0.90				100 mesh control screen				75.0
11	105					98			0.40				100 mesh control screen				99.0
11	201					98.5			0.80				200 mesh control screen				85.0
15	12120	0.5			0.2	99			0.85			28.0	51.0	16.0	3.0	1.0	1.0
15	40	0.5			0.2	99			0.90			16.0	13.0	13.0	5.0	12.0	41.0
15	120	0.5			0.2	99			0.90			0.0	0.5	3.0	3.0	8.5	85.0
15	200	0.5			0.2	98.6			0.90			0.0	0.0	trace	0.2	0.2	95.0
15	400	0.5			0.2	98.3			0.75			0.0	0.0	0.0	0.0	trace	99.9
BRASS							Zn										
6			90.0				10.0					2.0	15 to 35		15 to 35		60.0
6			90.0				10.0	0.5P				2.0	15 to 35		15 to 35		60.0
6			85.0				15.0					2.0	15 to 35		15 to 35		60.0
6			70.0				30.0					2.0	15 to 35		15 to 35		60.0
6			70.0				30.0	0.3P				2.0	15 to 35		15 to 35		60.0
6			78.5				20.0	1.5Pb		3.0	24-28	2.0	15 to 35		15 to 35		60.0
12	1109		85				15					2.0	15 to 35		15 to 35		60.0
12	1113		89.5				10	0.5P				2.0	15 to 35		15 to 35		60.0
12	1178		78.25				20	0.25P 1.5Pb				2.0	15 to 35		15 to 35		60.0
12	1163		78.5				20.0	1.5Pb				2.0	15 to 35		15 to 35		60.0

*g/cc **sec/50g. Sample † with 1% stearate @ 60,000 psi. (Code numbers on page 83)

PRECISE FILLING OF DIES *by new Baldwin powdered metal presses makes compacts more uniform...*



THEIR highly efficient shuttle type feeders enable Baldwin's new Model "L" and Model "C" powdered metal presses to compact parts much more uniformly. Air operated and cam controlled, this unique feeder moves from under a stationary hopper to a position over the die. It carries the same volume of material over the die cavity each time with a very smooth motion.

This shuttle is supported on guide rods with a spring loaded cutoff ring which prevents loss of material. Cleanline design of the feeder eliminates those recesses or projections that might keep the powder from filling the die cavity completely.

This is just one of the ways you'll benefit by specifying Baldwin Model "L" (50-ton) or Model "C" (100-ton) presses to meet the growing demand for powdered metal parts. These new presses are the very first designed specifically for use in compacting metal powders. Both feature sealed mechanisms, hydraulic heads, special fill adjustments, automatic lubrication and variable cycling.

For our new bulletins on "L" and "C" please write promptly to our Dept. 4756, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

For more information circle No. 13 on the Reader Service Card

Typical Properties Of Metal Powders — Cont.

Manufacturer		Composition						Hyd. Loss	App. Density*	Flowability**	Green Density†	Screen Analysis					
Code No.	Designation	% Fe	% Cu	% C	% Si	% Al	% Others					+ 100	− 100 + 150	− 150 + 200	− 200 + 250	− 250 + 325	− 325
BRASS																	
12	1110		90.0				10.0					2.0	15 to 35		15 to 35		60.0
12	1181		89.0				9.5	1.5Pb				2.0	15 to 35		15 to 35		60.0
BRONZE								Sn									
6			80.0				10.0Pb	10.0	0.3	5.0	15		0.2	2-5	13-23	6-13	13-23	43-58
11			90.0					10.0		2.2			100 mesh control screen					50.0
11	34		bal.					5-7		4.0			30 mesh control screen—90% plus 40					
11	36		bal.					5-7		4.0			30 mesh control screen—90% plus 60					
11	46		bal.					7.2-9.7		4.0			40 mesh control screen—90% plus 60					
11	61		bal.					8.2-9.7		4.0			60 mesh control screen—90% plus 100					
11	68		bal.					8.2-9.7		4.0			60 mesh control screen—90% plus 80					
11	83		bal.					9-10.5		4.0			80 mesh control screen—90% plus 150					
11	103		bal.					9-10.5		4.0			100 mesh control screen—90% plus 325					
12	1403		90.0					10.0					2.0	15 to 35		15 to 35		60.0
12	1410		93.5				1.5Pb	5.0					2.0	15 to 35		15 to 35		60.0
COPPER																		
1	AJL		99.5						0.30	3.5	24		0.8	7-17	17-27	3-10	15-25	35-45
1	LB		99.5						0.30	2.45	33		0.2	3-13	17-27	5-12	18-28	33-43
1	A		99.5						0.30	2.40	32		0.5	5-15	25-35	6-13	19-29	22-32
1	HB		99.5						0.30	2.75	30		0.2	1-11	14-24	5-12	15-25	42-52
1	LU		99.4						0.40	2.30	35		0.2	1-10	9-19	2-9	16-26	50-60
1	U		99.4						0.40	2.50	35		0.2	1-10	9-19	2-9	12-22	53-63
1	HU		99.4						0.40	2.70	32		0.2	1-10	7-17	2-9	13-23	54-64
1	M		99.25						0.50	2.50	40		0.2	1-6	5-15	1-6	10-20	63-73
1	LC		99.00						0.75	1.50			0.1	0.5	4.0	1.5	2-7	90.0
1	C		99.00						0.75	2.10			0.1	0.5	4.0	1.5	2-7	90.0
1	B		99.50						0.30	2.50	32		0.2	1-11	13-23	3-10	17-27	43-53
4	40JB	0.10	99.5		0.05	nil			0.35	3.0	30	7.7	95	5				
4	40RL	0.10	99.5		0.05	nil			0.35	3.0	30	7.6	60	40				
4	100RXA	0.10	99.4		0.05	nil			0.30	2.8	30	7.4	2	14	24	4	17	39
4	150RXA	0.10	99.4		0.05	nil			0.30	2.8	30	7.30	0.5	1.5	10	2	18	68
4	150RXS	0.10	99.4		0.05	nil			0.30	2.6	35	7.30	0.5	1.5	10	2	18	68
4	200RL	0.15	99.0		0.05	nil			0.80	2.4	nil	7.20	trace	trace	0.5	3.5	6	90
4	500RL	0.15	99.0		0.05	nil			0.80	2.2	nil	7.00	trace	trace	trace	0.5	1.5	98
5			99.5						0.3	1.90	30	7.9	trace	1-3	8-21	8-20	8-20	bal.
6			See listings for producer No. 1 above															
9			99.3						0.5	1.01	nil		trace	0.7	10.9	29		59.7
9	Venus Copper A		99.60							5.00	nil			4.0	19.0	23		54.0
11	105		97.5							1.50				200 mesh control screen				98.0
11	110		96.0							1.80				100 mesh control screen				85.0
11	151		99.0							2.40				150 mesh control screen				65.0
11	165		99.0							2.60				150 mesh control screen				65.0
11	201		98.5							2.30				200 mesh control screen				85.0
11	410		99.0							1.50			90	40 mesh control screen				
IRON								O_2	N_2									
2	E	98.1	nil	0.6	nil	nil	0.1	0.55		2.5			nil	nil	nil	trace	trace	100
2	TH	98.2	nil	0.5	nil	nil	0.1	0.55		2.5			nil	nil	nil	trace	trace	100
2	SF	98.2	nil	0.5	nil	nil	0.1	0.55		2.5			nil	nil	nil	trace	trace	100
2	C	99.5	nil	0.4	nil	nil	0.01	0.00		2.5			nil	nil	nil	trace	0-0.5	99.5+
2	HP	99.6	nil	0.01	nil	nil	0.01	0.00		2.5			nil	nil	nil	tarce	0.5-2	98.0+
2	L	99.6	nil	0.01	nil	nil	0.01	0.00		1.8			nil	nil	nil	trace	5.20	80-95
3	Ancor 80	97.5							0.8	2.3	35	6.17	5-10	10-20	15-20	3-5	20-30	25-35
6	I	98.5		0.20	0.25				1.0	2.9	25		1.0	12.0	21.0	11.0	21.0	34.0
6	V	98.5		0.20	0.25				1.0	2.40	30	6.0	1.0	12.0	21.0	11.0	21.0	34.0
6	100	99.0		0.04					0.09	2.3	34	6.5		14.0	20.0	5.0	21.0	40.0
7	HVA Std.	99.7	0.01	0.05	0.02	0.06Mn	.01Ni	.01P	0.5	3.4	24	6.8	6-20	15-25	10-20	20-30	10-15	25-35
7	HVA Spg.	99.7	0.01	0.05	0.02	0.06Mn	.01Ni	.01P	0.5	2.7	30	6.6	1-5	5-15	5-15	10-20	10-20	30-50
7	HVA Ex. F	99.6	0.001	0.08	0.02	0.08Mn	.001Ni	.001P	2.0	2.8	30	4.9						100
7	HVA Crn.	99.7	0.01	0.05	0.02	0.06Mn	.01Ni	.01P	0.5	2.6	33	6.8	1-5	11-22	18-25	21-25	10-14	22-30
8	21	98	nil	0.05	0.2	trace	tr-Ni		0.8	2.5	27	6.5	1.3	7.5	22	9.5	25.7	34

*g/cc **sec/50g. Sample † with 1% stearate @ 60,000 psi. (Code numbers on page 83)

NOW available

DREVER'S

Bulletin

on Sintering and Reduction Furnaces

See us at Booth #5, Metal Powder Show, Philadelphia, Pa. May 10-12, 1955, and review your furnace requirements with our engineers.

This new bulletin illustrates and outlines some of the many fuel-fired and electrically heated sintering and reduction furnaces of the batch and continuous types installed by the Drever Company.

Copies of this Bulletin No. 101 will be sent on request.

RED LION ROAD AND PHILMONT AVE. DREVER COMPANY **BETHAYRES, PA.**

For more information circle No. 25 on the Reader Service Card

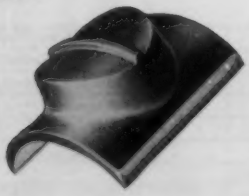
Typical Properties Of Metal Powders — Cont.

Manufacturer		Composition						Hyd. Loss	App. Density*	Flowability**	Green Density†	Screen Analysis					
Code No.	Designation	% Fe	% Cu	% C	% Si	% Al	% Others					+ 100	100 + 150	150 + 200	200 + 250	250 + 325	- 325
IRON																	
8	15	93	5-5.5	0.05	0.2	trace		0.8	2.5	23	6.3	2.9	16.6	26.4	6.5	7.9	29
8	18	90	8-8.5	0.05	0.2	trace		0.8	2.5	27	6.6	1.7	23.9	23.1	13.1	17.2	21.1
10	MP-1	98.4		0.12	0.15			0.8	2.4	32	6.2	1.0	13	20	27		39
10	MP-2	98.4		0.05	0.15			1.0	2.5	28	6.4	6.0	20	23	25		26
10	MP-3	98.4		0.08	0.15			0.7	2.5	28	6.4	1.0	14	19	30		36
10	MP-4	98.4		0.10	0.25			1.0	2.7	26		1.0	11	16	30		42
10	MP-5	87.4	8.0	0.15	0.15		3.0Ni	0.8	2.5	30	6.4	5.0	18	22	25		30
10	MP-6	98.5		0.05	0.10			1.0	2.2	33		16.0	24	25	20		15
10	MP-7	97.4		0.08	0.10		1.0Mo	0.8	2.5	28		1.0	12	17	30		40
11	180	98.0							2.5				100 mesh control screen				40.0
11	182	98.0							2.3				100 mesh control screen				40.0
11	185	98.0							1.85				100 mesh control screen				40.0
13	A-210	95.5		0.02	0.007	.003Mn		0.4	2.5	35	6.7	1.0	18	22	5	19	35
13	A-211	99.2		0.04	0.007	.003Mn		0.5	2.4		6.7	1.0	17	14	8	15	45
13	A-220	98.7		0.03	0.007	.003Mn		1.2	2.2		6.6			1.5	2.5	15	81
13	A-230	98.6		0.03	0.007	.003Mn		1.3	2.1		6.5				0.5	1.5	98
13	B-211	98.0		0.25	0.06	.25Mn		0.9	2.7	30	6.5	1.0	12	22	6	24	35
13	B-212	98.0		0.10	0.10	.03Mn		0.7	2.5	30	6.3	2.0	30	25	5	17	21
13	B-214	98.0		0.05	0.08	.03Mn		0.3	2.7	27	6.5	0.5	25	25	6	20	24
13	B-215	98.0		0.05	0.10	.03Mn		0.6	2.9	24	6.3	0.4	20	22	6	22	30
13	B-260	98.0		0.25	0.06	.25Mn		1.0	2.5	27	6.2	21	22	18	7	15	17
13	93	97.0		0.20	0.06	.25Mn		0.75	2.7	27	6.3	22	26	16	5	15	16
14	Niagara	98.25		0.02	0.09			0.9	2.3	28	6.05		14.5	21.5	14.5	10.8	38.7
14	T	99.7		0.01	0.001			0.1	2.5	31	6.7		0.5	7.5	5.5	44	42.5
17	RZ-365	98.7		0.08	0.04	.15Mn		0.75	2.4	32	6.4	1.0	3.0	15	24	34	23
17	RZ-40	98.2		0.08	0.04	.13Mn		1.25	2.5			nil	2.0	48	30	12	8
LEAD																	
4	408							0.5	5.5	40		65					
4	1008							0.5	4.75			2					75
4	2008							0.5	4.75			1					95
4	F							0.5	4.25							10	90
4	SF							0.5	4.25							1	99
11	101						99.5Pb		4.00				100 mesh control screen				95
11	102						99.5Pb		4.50				100 mesh control screen				85
11	104						99.5Pb		5.00				100 mesh control screen				40
11	201						99.5Pb		3.50				200 mesh control screen				98
MANGANESE							Mn										
11	101						99.0		2.6				100 mesh control screen				50
11	201						99.0		2.6				200 mesh control screen				75
11	301						99.0		2.6				325 mesh control screen				95
13	E-110	.001					98.5	1.0	3.2				10	10	2	6	72
13	E-120	.001					98.0	1.5	2.8						1	7	92
13	E-130	.001					97.5	2.0	2.6							.1	99.9
NICKEL							Ni										
11	102						99.25		2.6				100 mesh control screen				50
11	152						99.00		2.6				150 mesh control screen				75
11	202						99.00		2.6				200 mesh control screen				80
11	302						99.00		2.6				325 mesh control screen				95
13	F-110	.060		.03	.020		99.25	0.5	4.0				10	18	5	17	50
13	F-120	.060		.03	.02		99.20	0.55	3.6					.5	1.5	16	82
13	F-130	.070		.03	.02		99.15	0.60	3.4							.5	99.5
STEEL (Stainless and low alloy)																	
6	302	18Cr	8Ni					.50	3.1				25	25	25		25
6	302B	18Cr	8Ni					.35	2.8	28			25	25	25		25
6	316	18Cr	11Ni					.35	2.7	33			25	25	25		25
6	318	18Cr	11Ni				1Cb	.45	2.7	29			25	25	25		25
6	410	12.5Cr	.5Ni										25	25	25		25
6	4650			.2-1.0				.36	3.9	17			25	25	25		25
16	302B	18Cr	8Ni	0.1	2.5	.8Mn		.35	2.6	28	5.5	3	20	25	14	13	25

*g/cc **sec/50g. Sample † with 1% stearate @ 60,000 psi. (Code numbers on page 83)

The striking difference in color shows comparative resistance to oxidation, proves superiority of RESISTOX Metal Powder (left) when exposed same length of time as ordinary powder.

Resistox Process gives Glidden Metal Powders more stability through greater resistance to oxidation!



Glidden Resistox Metal Powders offer you distinct storage and production advantages over ordinary metal powders because they resist oxidation from 5 to 10 times longer!

This exclusive Resistox Process permits storage over long periods of time without fear of oxidation, thus eliminating production and product-quality problems.

Glidden Resistox Metal Powders meet every requirement for uniformity, purity, consistency, strength. There is less material waste and die wear. They permit faster production of precision parts with greatly improved finish, appearance and performance characteristics.

Let us supply you with more complete information on these Glidden products: Resistox Copper and Lead Powders, Cuprous Oxide, Cupric Oxide and Cubond (Copper Brazing Paste). There's no obligation.

THE GLIDDEN COMPANY

CHEMICALS • PIGMENTS • METALS DIVISION

Baltimore, Md. • Collinsville, Ill.
Hammond, Ind. • Scranton, Pa.

QUALITY Glidden PRODUCTS

For more information circle No. 35 on the Reader Service Card

Typical Properties Of Metal Powders — Cont.

Manufacturer		Composition							Hyd. Loss	App. Density*	Flowability**	Green Density†	Screen Analysis					
Code No	Designation	% Fe	% Cu	% C	% Si	% Al	% Others						+ 100	− 100 + 150	− 150 + 200	− 200 + 250	− 250 + 325	− 325
STEEL (stainless and low alloy)																		
16	316	17Cr	11Ni	0.1	1.2	2.5Mo			.90	2.9	28	5.4	3	20	25	14	13	25
16		17Cr	11Ni	0.1	2.5	2.5Mo			.35	2.3	32	5.7	3	20	25	14	13	25
16	4650		2Ni	0.5	0.3	0.3Mo			.50	3.4	20	5.4	3	20	25	14	13	25
16	4650-A		2Ni	0.5	0.3	0.3Mo			0.5	2.4		6.2	3	20	24	13	12	28
19	302		8-10Ni	.08-.15	1	2Mn	17-19Cr		.23	3.41	18.6	5.55		0.5	7.5	15	22	55
19	316		10-14Ni	.10	1	2Mn	16-18Cr		.14	3.5	20.1	5.55		6.5	32.6	27.6	20.9	12.7
							2-3Mo											
19	17-7		6-8Ni	.08-.15	1	2Mn	16-18Cr											
19	18-8Fm		8-10Ni	.15	1	2Mn	17-19Cr											
19	18-8		8-10Ni	.08	1	2Mn	18-20Cr											
19	18-11Fs		10-13Ni	.12	1	2Mn	17-19Cr											
19	20-10		10-12Ni	.08	1	2Mn	19-21Cr											
19	25-12		12-15Ni	.20	1	2Mn	22-24Cr											
19	25-20		19-22Ni	.25	1.5	2Mn	24-26Cr											

(Hydrogen loss on stainless steel, max. in hydrogen, 30 min. at 2300 F) (Green density on stainless steel, no lubricant, pressure 80,000 psi)

TIN

1							99.5Sn		.10	2.7			trace	.2	1.0	2.0		90
5							99.9Sn			3.9			nil	1.7	9.0	8.0	10	98
6							99.5Sn		.10	2.7			trace	.2	1.0	2.0		90
11	51						99.5Sn			3.0			90	50 mesh control screen				
11	101						99.5Sn			2.50			100 mesh control screen					95
11	102						99.5Sn			3.0			100 mesh control screen					85
11	103						99.5Sn			3.1			100 mesh control screen					95
11	105						99.3Sn			1.3			200 mesh control screen					98
11	124						99.5Sn			3.5			100 mesh control screen					75
11	201						99.5Sn			3.0			200 mesh control screen					95
11	301						99.5Sn			3.00			325 mesh control screen					98

TITANIUM ALLOYS

18		Titanium Hydride								0.97		2.56	trace	0.3	0.6	0.8	1.8	96.5
18							20.0Ti	80.0Co		1.44		4.60	2.3	4.3	12.3	13.9	17.1	50.1
18							60.0Ti	40.0Co										
18							80.0Ti	20.0Co										
18	421						30.0Ti	70.0Ni		2.17		5.58	1.2	2.7	4.6	5.7	9.0	76.8
18	492						50.0Ti	50.0Ni		2.05		4.00	0.7	5.2	12.3	15.3	24.5	42.0
18	427						70.0Ti	30.0Ni		2.23		3.68	0.2	0.8	2.6	5.2	11.7	79.5

ZIRCONIUM ALLOYS

18	361	Zirconium Hydride								1.48		4.00	trace	0.2	0.4	0.6	1.0	97.8
18	461						30.0Zr	70.0Ni		2.23		5.58	0.2	0.5	0.8	0.9	1.8	95.8
18	466						70.0Zr	30.0Ni		1.97		4.13	0.1	0.3	0.6	1.0	2.7	95.3

CHROMIUM ALLOYS

18	380						20.0Cr	80.0Ni		2.67	28	5.78	11.9	13.5	15.5	13.1	14.0	32.0
18							50.0Cr	50.0Ni		2.07		5.12	5.3	7.4	11.8	10.4	11.3	53.8
18	385						80.0Cr	20.0Ni		1.77		4.83	0.1	2.5	6.4	5.6	9.0	76.4
18							30.0Cr	70.0Co		1.75	42	5.28	4.9	18.6	19.1	14.7	14.2	28.5
18							70.0Cr	30.0Co		1.82		4.42	0.2	1.0	1.9	2.2	3.4	91.3

*g/cc **sec/50g. Sample † with 1% stearate @ 60,000 psi.

Code numbers of manufacturers listed on pages 73-83:

METAL POWDER COMPACTS

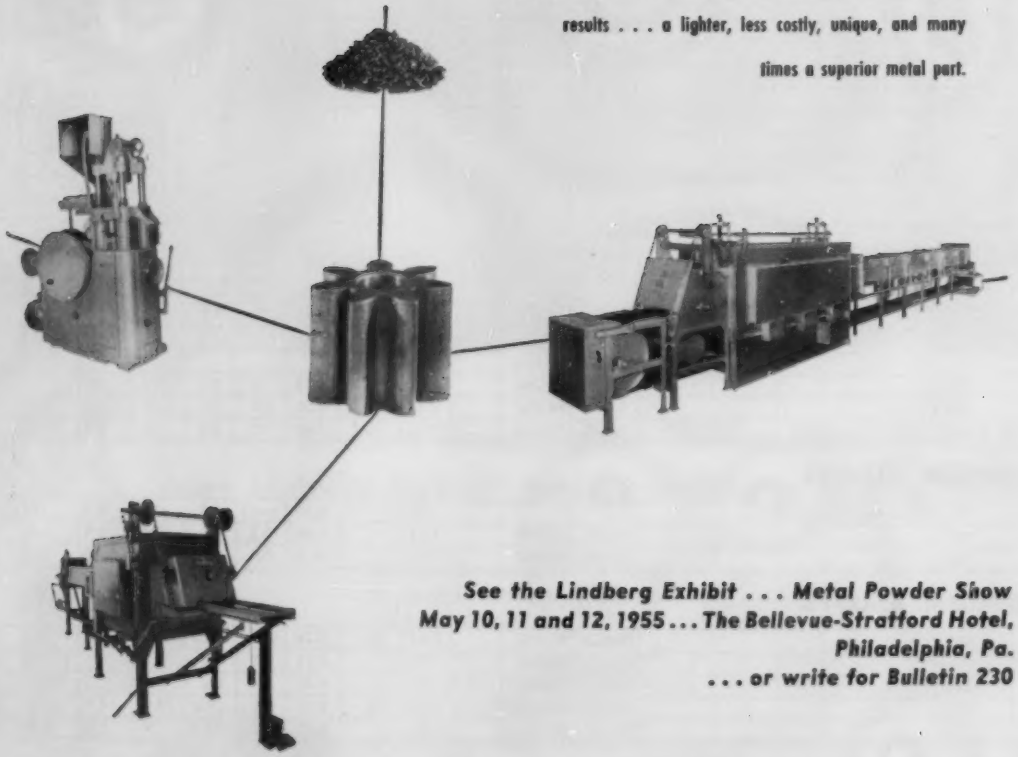
1. Bound Brook Oil-less Bearing Co.
2. Chicago Powdered Metal Products Co.
3. Dixon Sintaloy, Inc.
4. Ferro Powdered Metals, Inc.
5. General Powdered Metals, Inc.
6. International Powder Metallurgy Co., Inc.
7. Johnson Bronze Co.
8. Keystone Carbon Co.
9. Metal Powder Products Corp.
10. Michigan Powdered Metal Products Corp.
11. Powdercraft Corp.
12. Globe Industries, Inc., Supermet Division
13. United States Graphite Co., The
14. Yale & Towne Mfg. Co., The, Powdered Metal Products Division
15. Chrysler Corp., Amplex Division
16. Detroit Sintered Metals Corp.

METAL POWDERS

1. American Metals Co. Ltd., The
2. General Aniline and Film Corp., Antara Chemicals Division
3. Ekstrand & Thaland, Inc. & Hoeganaes Sponge Iron Corp.
4. Glidden Co., The, Chemicals-Pigments-Metals Division
5. Greenback Industries, Inc.
6. Charles Hardy, Inc.
7. A. Johnson & Co., Inc.
8. Magnetic Powders, Inc.
9. Malone Metal Powders, Inc.
10. Metal Powders Ltd.
11. Metals Disintegrating Co.
12. New Jersey Zinc Co., The
13. National Radiator Co., The, Plastic Metals Division
14. Pyron Corp.
15. Reynolds Metals Co.
16. Vanadium-Alloys Steel Co.
17. Easton Metal Powder Co., Inc.
18. Metal Hydrides, Inc.
19. Alloy Metal Powders, Inc.

sintering powdered metal parts

Powder metallurgy . . . a process for forming metal parts from fine metal powders. Mix a quantity of metal powder with lubricants . . . compress to shape . . . sinter "green" briquette in furnace . . . size or coin if necessary . . . results . . . a lighter, less costly, unique, and many times a superior metal part.



See the Lindberg Exhibit . . . Metal Powder Show May 10, 11 and 12, 1955 . . . The Bellevue-Stratford Hotel, Philadelphia, Pa. . . . or write for Bulletin 230

LINDBERG FURNACES

Lindberg Engineering Company,
2463 West Hubbard Street, Chicago 12, Illinois

For More information circle No. 50 on the Reader Service Card

4th annual

POWDER METALLURGY DIRECTORY

SECTION 2
PRODUCT SOURCES

For addresses of companies listed, see Section 3, page 107.

COMPONENTS FABRICATORS

BEARINGS — Copper or Iron Base

American Brake Shoe Co.
Sintermet Div.

American Electro Metal Corp.

American Powdered Metals, Inc.

Asco Sintering Co.

Bassick Co., The

Bound Brook Oil-less Bearing Co.

Brockway Pressed Metals, Inc.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

Ford Motor Co.
Dearborn General Mfg. Div.

General Powdered Metal Products Co., Inc.

General Sintering Corp.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Johnson Bronze Co.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Metal Powder Products, Inc.

Michigan Powdered Metal Products Co.

Moraine Products Div.
General Motors Corp.

National Molded Products, Inc.

Parker White-Metal Co.

Permanent Filter Corp.

Picco, Inc.

Powder Metal Products Co.

Powdercraft Corp.

Precision Metal Products Co.

Presmet Corp., The

Reese Metal Products Corp.

St. Marys Carbon Co.

Sintered Metals, Inc.

Superior Carbon Products, Inc.

Symmco, Inc.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.

Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

BEARINGS — Other types

American Electro Metal Corp.

Asco Sintering Co.

Chrysler Corp.
Amplex Div.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Ferro Powdered Metals, Inc.

General Powdered Metal Products Co., Inc.

Michigan Powdered Metal Products Co.

Powdercraft Corp.

Sintered Metals, Inc.

Stackpole Carbon Co.

Superior Carbon Products, Inc.

Symmco, Inc.

United States Graphite Co., The

Wakefield Bearing Corp.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

CEMENTED CARBIDES — All types

Adamas Carbide Corp.

American Electro Metal Corp.

General Electric Co.
Carboloy Dept.

Sintercast Corp. of America

Vascaloy-Ramet Corp.

Welded Carbide Tool Co.

Wesson Metal Corp.

CONTACT MATERIALS — Pure metals (platinum, silver, etc.)

Fansteel Metallurgical Corp.

Gibson Electric Co.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

P. R. Mallory & Co., Inc.

Metroloy Co.

Sintered Metals, Inc.

The high-quality powder metal parts shown here are produced by Dixon Sintaloy Inc., Stamford, Connecticut. A large user of Stokes presses, this progressive firm has done outstanding work in applying powder metallurgy to the economical production of a wide variety of parts for its customers.

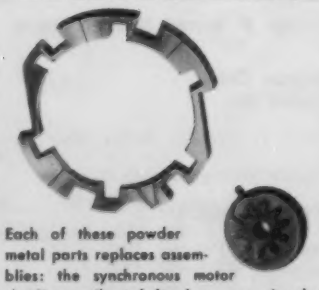
Quantity powder-metal production of this in-the-knob lock part saved one manufacturer over $25,000 per year. In addition, he avoided an outlay for machine tools estimated at $30,000. I.D. tolerances on this leaded brass part are held to ±.0025 inches.

$25,000 saved on this Powder Metal Part

Parts which are difficult to machine because of complex contours—or costly, because of great metal waste—are economically made on fully automatic powder metal presses.

Stokes has been building presses *specifically for the compacting of metal powders for over thirty years.* There's an automatic Stokes press for every powder metal application, from 1½-ton capacity to large presses of 500 tons. Our experience in punch and die design and laboratory facilities for compacting sample parts are available to help you investigate the cost-saving possibilities of powder metallurgy.

Write for the following pieces of literature: "Powder Metallurgy Today," Catalog of Stokes Powder Metal Presses, No. 801, and "How To Save Money on Punches and Dies."



Each of these powder metal parts replaces assemblies: the synchronous motor shading coil at left above, previously assembled from sheet metal stampings, is made of high-conductivity metal powders to close dimensional tolerances at cost savings of 50%; the gear at right is one of nine used in an adding machine with an I.D. tolerance of ±.0005 inches. Formerly a three-part assembly, cost savings on this sintered iron part are 70%.

F. J. Stokes Machine Company
Philadelphia 20, Pa.

Offices in Principal Cities
Representatives Throughout the World

STOKES

For more information circle No. 81 on the Reader Service Card

Superior Carbon Products, Inc.

Wakefield Bearing Corp.

CONTACT MATERIALS — Tungsten copper, tungsten silver, etc.

Fansteel Metallurgical Corp.

Gibson Electric Co.

P. R. Mallory & Co., Inc.

Parker White-Metal Co.

Stackpole Carbon Co.

Superior Carbon Products, Inc.

CORES — High Frequency

Aladdin Radio Industries, Inc.

Arnold Engineering Co., The

Henry L. Crowley & Co., Inc.

Eberhart Steel Products Corp. PM Division

Ferroxcube Corp. of America

Indar Corp.

Kwikset Powdered Metal Products

Magnetic Core Corp.

Micrometals

National Moldite Co.

Pyroferric Co., Inc.

Quality Components, Inc.

Radio Cores, Inc.

Stackpole Carbon Co.

Yale & Towne Mfg. Co., The Powdered Metal Products Div.

CORES — Low Frequency

Aladdin Radio Industries, Inc.

Arnold Engineering Co., The

Henry L. Crowley & Co., Inc.

Eberhart Steel Products Corp. PM Division

Ferroxcube Corp. of America

Indar Corp.

Kwikset Powdered Metal Products

Magnetic Core Corp.

National Moldite Co.

Pyroferric Co., Inc.

Quality Components, Inc.

Stackpole Carbon Co.

Yale & Towne Mfg. Co., The Powdered Metal Products Div.

ELECTRICAL COMPONENTS — Collector Rings

Asco Sintering Co.

TWO machined parts $1.00

TEN Powdermet* PARTS .... $1.00 (10¢ each)

Don't cut parts—*Cut Costs* with YALE Powdered Metal Parts

Yes, powder metallurgy has an important price story—because when you save the extensive and costly operations involved in machining, it shows up in *more parts* and lower production costs!

But at Yale & Towne, there's another story of *equal* importance ...*complete* engineering service, the kind you can trust—from consultation through production and delivery of parts that are *really* right!

Engineering service has given Yale & Towne its position of leadership in powder metallurgy. We are careful to *recommend only applications where Powdermet* parts will perform successfully.* Then, in design and production of these parts, Yale & Towne offers the experience, know-how, modern facilities and creative ingenuity that *assure* best results.

As a part of this complete engineering service, Yale & Towne maintains a continuous special training program for well-qualified engineers. These men become Powdermet* consultants—available to discuss the advantages and limitations of Powdermet* parts *right in your own plant.* They will show you how Powdermet* may cut your production costs and improve your product. And there is *no obligation* for this engineering counsel.

TAKE ADVANTAGE of Yale & Towne's skilled engineering assistance on your powdered metal problems.

Arrange for a visit by a Yale & Towne consultant —today!

YALE & TOWNE

THE YALE & TOWNE MANUFACTURING CO

Powdered Metal Products Division

9335 BELMONT AVE. • FRANKLIN PARK, ILL.

Send Today for Free Informative Booklet on Powdered Metals

The Yale & Towne Manufacturing Company
Powdered Metal Products Division
9335 West Belmont Avenue
Franklin Park, Illinois

☐ Send Booklet ☐ Send information on Powdermet* parts for attached specifications or drawings.
☐ Have a Yale & Towne Powdermet* engineer call on me.

Name.....Title.....

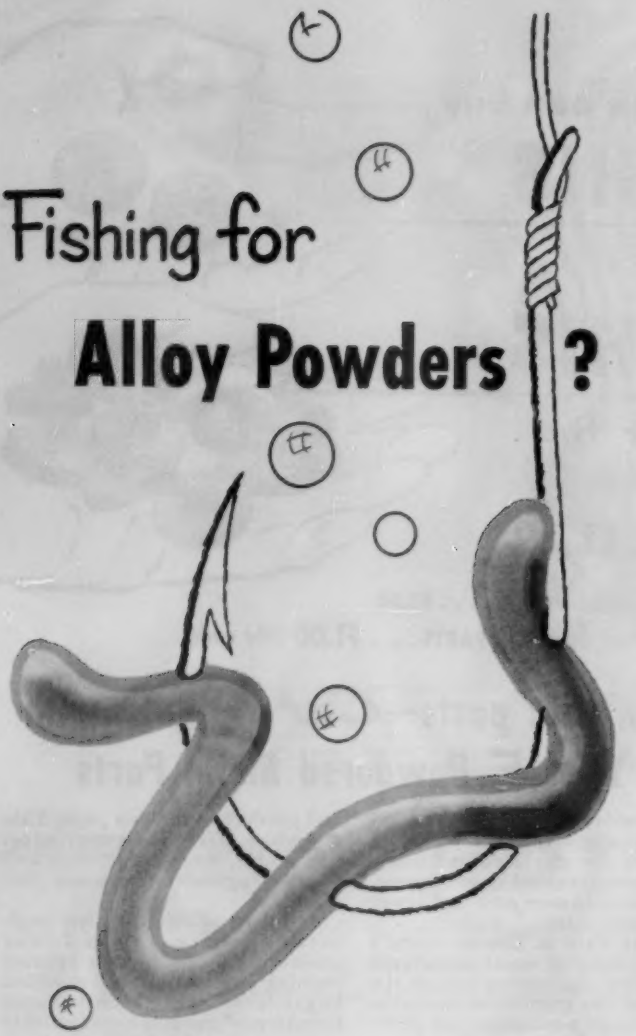
Company.....

Street Address.....

City.....Zone.....State.....

*Registered Trade-Mark

For more information circle No. 89 on the Reader Service Card



Fishing for Alloy Powders ?

Save time . . . ask the men who know. In over seventeen years, MH metallurgical engineers have unlocked many tough alloy combination problems. Such specific alloy requirements as corrosion resistance, conductivity, resistance to high temperature oxidation, high strength at elevated temperatures, magnetic alloys are met daily with speed, accuracy, and volume production. Metal Hydrides' alloys are clean, uniform in composition, and of controlled particle size.

Inquiries regarding alloy combination problems are welcome and will receive prompt attention, without obligation.

MH

Metal Hydrides
INCORPORATED

20 CONGRESS STREET, BEVERLY, MASSACHUSETTS

For more information circle No. 53 on the Reader Service Card

Chrysler Corp.
Amplex Div.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Ferro Powdered Metals, Inc.

General Powdered Metal Products, Inc.

Kwikset Powdered Metal Products

Metal Powder Products, Inc.

Moraine Products Div.
General Motors Corp.

Parker White-Metal Co.

Powdercraft Corp.

Sintered Metals, Inc.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

ELECTRICAL COMPONENTS
Commutator Segments

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

General Powdered Metal Products Co., Inc.

Kwikset Powdered Metal Products

Sintered Metals, Inc.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

ELECTRICAL COMPONENTS
Pole Pieces

Asco Sintering Co.

Capitol Mfg. Corp.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

General Powdered Metal Products Co., Inc.

General Sintering Corp.

Indar Corp.

International Powder Metallurgy Co., Inc.

Kwikset Powdered Metal Products

Magnetic Core Corp.

Merriman Bros., Inc.

Metal Powder Products, Inc.

Michigan Powdered Metal Products Co.

Moraine Products Div. General Motors Corp.

Parker White-Metal Co.

Picco, Inc.

Powdercraft Corp.

Presmet Corp., The

Sintered Metals, Inc.

Thompson Products, Inc. Metallurgical Products Div.

Watertown Mfg. Co.

Yale & Towne Mfg. Co., The Powdered Metal Products Div.

ELECTRICAL COMPONENTS — Rotor Segments

Asco Sintering Co.

Chicago Powdered Metal Products Co.

Henry L. Crowley & Co., Inc.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp. PM Division

General Powdered Metal Products Co., Inc.

Indar Corp.

Kwikset Powdered Metal Products

Picco, Inc.

Sintered Metals, Inc.

FRICTION MATERIALS

American Brake Shoe Co. Sintermet Div.

Chrysler Corp. Amplex Div.

Ferro Powdered Metals, Inc.

General Metals Powder Co.

Moraine Products Div. General Motors Corp.

Picco, Inc.

Powdercraft Corp.

Raybestos-Manhattan, Inc.

Wakefield Bearing Corp.

For more information circle No. 55 on the Reader Service Card

Metal Powder Products, inc.

PARTS MADE FROM METAL

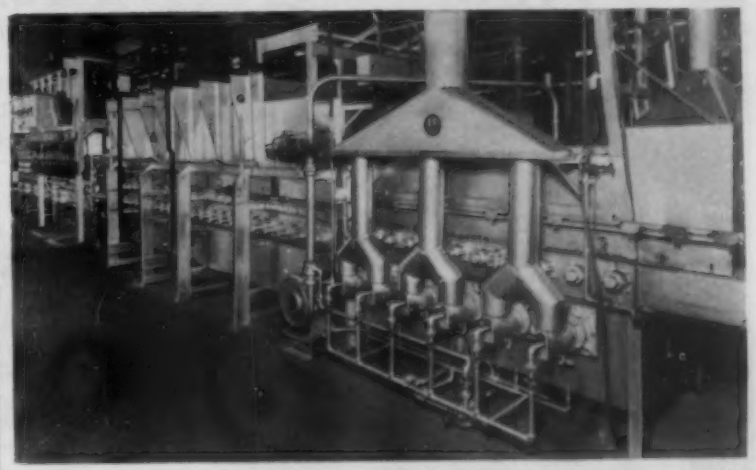
POWDER WITH ACCURACY

AND DEPENDABILITY

we specialize in

SERVICE

P.O. BOX 189D • LOGAN, OHIO



EF combination gas fired radiant tube and electrically heated roller hearth large capacity furnace for sintering metal powder parts at temperatures up to 2050° F.

EF Sintering Furnaces

For Ferrous and Non-Ferrous Powder Products Provide for —

- lowest cost per pound for the sintering operation.
- maximum uniformity of size for the sintered products.
- maximum pounds of quality product per dollar of investment.

We have built many sizes and types of furnaces for processing a wide variety of ferrous and non-ferrous metal powder products — also continuous equipment for bonding metal powders to strip and for other processes.

Long experience with special atmospheres, metal powders and all heat processing phases in connection with powder metallurgy has enabled EF engineers to develop and install equipment for producing some rather outstanding results.

With our extensive experience and complete manufacturing facilities we are in position to build the size and type of equipment to fit your specific requirements.

We would like to discuss some of our latest furnace developments with you, if interested.

THE ELECTRIC FURNACE CO.
Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces — For Any Process, Product or Production.

For more information circle No. 28 on the Reader Service Card

What do you need?

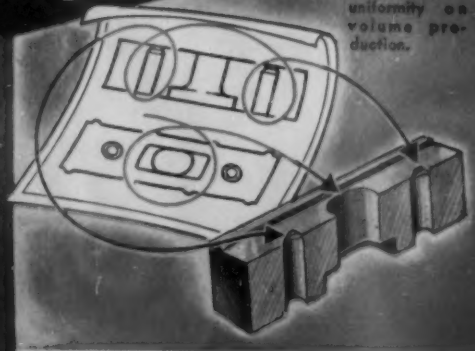
Ductility?

An example of the superior properties obtainable with the new Sintaloy process.

Sintered Brass?

Just one of the wide variety of alloys being fabricated by Sintaloy.

Uniformity?



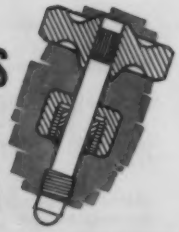
Advanced techniques assure uniformity on volume production.

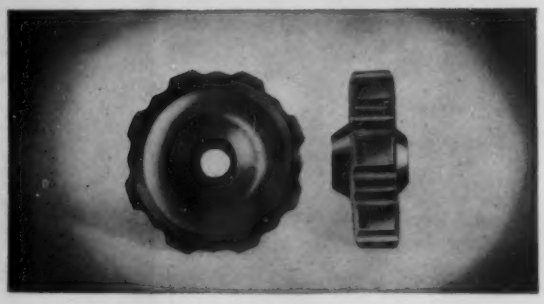
Write for your copy of "Advanced Powder Metallurgy" which describes Sintaloy's unusual plant facilities.

DIXON SINTALOY INC.
A subsidiary of The Joseph Dixon Crucible Company
535 Hope St. Stamford, Conn.

For more information circle No. 23 on the Reader Service Card

Linde Saves 2 Ways with BRASS POWDER PARTS

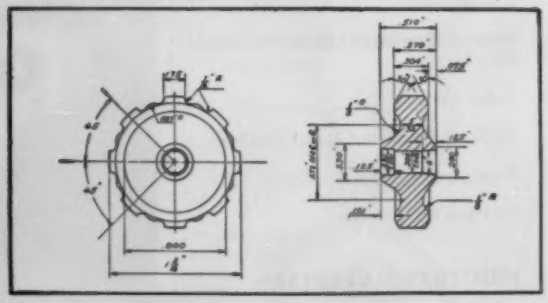




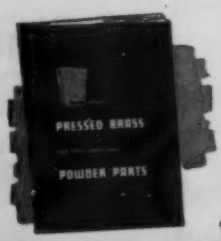
By specifying this valve wheel for manufacture as a brass powder part, Linde Air Products Company engineers not only reduced the manufacturing cost 25%, but effected a 50% saving in assembly. Formerly made from extruded brass bar stock and shaped by screw machine, the wheel is now pressed from brass powder* to finished shape and size in one operation.

The sintered brass compact is ready for use as is, with tolerances at 1/64" for all fractional dimensions and ±.005" for all decimal dimensions. Because of this accuracy, the wheel is now assembled to a valve stem by merely a press fit and a staking operation.

*Parker White Metal Company, Erie, Pa.



What can BRASS POWDER PARTS do for you?



For detailed information on the design, properties, production and application of brass and other nonferrous powder parts you should have a copy of our manual. It will give you 24 case histories of brass and nickel silver powder structural parts to assist in evaluating this means of production in terms of your particular needs.

SEND FOR YOUR COPY

THE NEW JERSEY ZINC COMPANY
160 Front Street New York 38, N. Y.

For more information circle No. 68 on the Reader Service Card

S. K. Wellman Co., The

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

MAGNETIC MATERIALS
Hard - Alnico Type

Arnold Engineering Co., The

Henry L. Crowley & Co., Inc.

Eberhart Steel Products Corp.
PM Division

Ferroxcube Corp. of America

General Electric Co.
Carboloy Dept.

Indar Corp.

Indiana Steel Products Co.

National Diamond Laboratory

Permag Corp.

MAGNETIC MATERIALS
Hard - Other Types

Arnold Engineering Co., The
(Cunico, Cunife)

Ferroxcube Corp. of America
(Magnadur)

MAGNETIC MATERIALS
Soft

American Electro Metal Corp.
(iron silicon, iron)

Arnold Engineering Co., The
(iron nickel, permalloy)

Asco Sintering Co.
(iron nickel, iron)

Capitol Mfg. Corp.
(iron nickel)

Henry L. Crowley & Co., Inc.
(iron nickel)

Detroit Sintered Metals Corp.
(iron)

Engineered Plastics, Inc.
American Sinterings Div.
(iron nickel)

Ferro Powdered Metals, Inc.
(iron nickel)

Ferroxcube Corp. of America
(Ferroxcube)

General Powdered Metal Products Co., Inc.

General Sintering Corp.
(iron nickel)

Indar Corp.
(iron nickel)

Kwikset Powdered Metal Products
(iron nickel, iron silicon)

Metal Powder Products, Inc.
(iron nickel, iron)

Moraine Products Div.
General Motors Corp.

Picco, Inc.
(iron nickel)

Powdercraft Corp.
(iron nickel, iron)

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.
(iron nickel, iron silicon, iron)

STRUCTURAL PARTS
Brass

American Electro Metal Corp.

Asco Sintering Co.

Bassick Co., The

Bound Brook Oil-less Bearing Co.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Dixon Sintaloy, Inc.

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

General Powdered Metal Products Co., Inc.

General Sintering Corp.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Moraine Products Div.
General Motors Corp.

National Molded Products, Inc.

Parker White-Metal Co.

Picco, Inc.

Powdercraft Corp.

Presmet Corp., The

Pyroferric Co., Inc.

Reese Metal Products Corp.

Sintered Metals, Inc.

Superior Carbon Products, Inc.

Symmco, Inc.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.

Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

STRUCTURAL PARTS
Copper Base

American Electro Metal Corp.

American Powdered Metals, Inc.

Asco Sintering Co.

Bassick Co., The

Bound Brook Oil-less Bearing Co.

Brockway Pressed Metals, Inc.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

Ford Motor Co.
Dearborn General Mfg. Div.

General Powdered Metal Products Co., Inc.

General Sintering Corp.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Johnson Bronze Co.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Metal Powder Products, Inc.

Moraine Products Div.,
General Motors Corp.

National Diamond Laboratory

National Molded Products, Inc.

Parker White-Metal Co.

Picco, Inc.

Powdercraft Corp.

Keystone

● leadership in powder metallurgy research, design and manufacture since 1927

research

widens powdered metal horizons every year

Beginning with pioneer work on the pre-oiled bearing, Keystone powdered metal research went on to develop the famous D-10 brass-graphite formula (a true oilless bearing material). Then, to iron bearings, with research and testing experience on iron bearings unsurpassed in the industry. Today, special corrosion-resistant finishes, the first successful stainless steel parts, and new high density alloy steel parts for structural applications are outstanding Keystone achievements. On the way: titanium parts, extrusion of powdered metal compacts, improved finishing techniques, for ever-better products.

design

always in the forefront of progress

Mastery of die design for parts of bronze, brass, iron, aluminum, nickel silver, stainless and alloy steels is the result of unrivalled Keystone experience and production know-how. Designing for economy and practicality of production extends also to equipment, much of which is original in design for greater versatility and lower cost for the customer. Among many Keystone design firsts: the molded flange in the middle of a bearing, and below-commercial-tolerance bearings at no increase in cost—notable achievements in the field.

manufacture

combines the facilities and capacity you need

Keystone produces more than 86,000,000 pieces—over 2,500,000 pounds—of powdered metal parts per year. This production capacity is governed by elaborate quality controls and a complete pilot plant division, where all dies, equipment and powder grades are carefully checked out before mass production begins. Regardless of the size or complication of your powdered metal part requirements, you will find complete ability to handle them satisfactorily at Keystone. We will be glad to furnish quotations on your specific applications. Let us consult with you, without obligation.

Keystone CARBON COMPANY

ST. MARYS, PENNSYLVANIA

Write for your free copy of this introductory folder on Keystone Powder Metallurgy.

For more information circle No. 46 on the Reader Service Card

Precision Metal Products Co.

Presmet Corp., The

Reese Metal Products Corp.

St. Marys Carbon Co.

Sintered Metals, Inc.

Superior Carbon Products, Inc.

Symmco, Inc.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.

Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

STRUCTURAL PARTS
Iron Base, Controlled Porosity

American Electro Metal Corp.

American Powdered Metals, Inc.

Asco Sintering Co.

Bassick Co., The

Bound Brook Oil-less Bearing Co.

Brockway Pressed Metals, Inc.

Burgess-Norton Mfg. Co.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

Ford Motor Co.
Dearborn General Mfg. Div.

General Powdered Metal Products Co., Inc.

Globe Industries
Supermet Div.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Metal Powder Products, Inc.

Michigan Powdered Metal Products Co.

Moraine Products Div.
General Motors Corp.

Parker White-Metal Co.

Picco, Inc.

Powdercraft Corp.

Precision Metal Products Co.

Presmet Corp., The

Pyroferric Co., Inc.

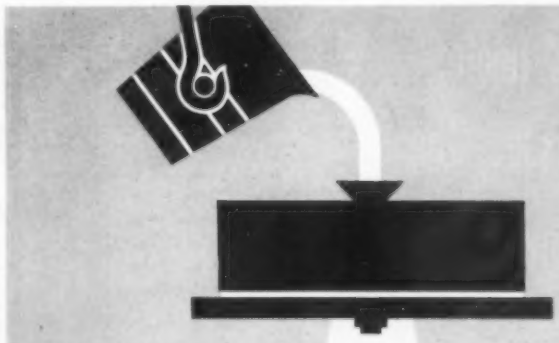
Reese Metal Products Corp.

St. Marys Carbon Co.

Sintered Metals, Inc.

Superior Carbon Products, Inc.

Symmco, Inc.



Easton RZ iron powder contributes to low production costs

Easton's RZ atomization process symbolized here is giving users quality and cost advantages they never guessed could be obtained in this country.

The Easton process has finally made possible the production of a high-quality powder from plentiful domestic mild steel scrap.

Cost-saving without sacrifice in quality is further implemented because the process permits annealing *without* the use of expensive reducing gas.

There are Easton RZ grades to suit *your* requirements for powder metallurgy, flame cutting, scarfing, washing, welding electrode coating, electronic and chemical applications. Write, stating specific requirements. E.4.3

EASTON METAL POWDER COMPANY, Inc.

233 Broadway, New York 7, N.Y.

EASTON RZ

RZ IRON POWDER FOR EVERY REQUIREMENT

For more information circle No. 26 on the Reader Service Card

the NEWEST advancement in the famous KUX line of powder metal presses—the BIG 4 hydraulic series

These powerful high tonnage presses—fully hydraulic in operation—provide upper and LOWER punch pressure — deep die fills up to 10"—and complete adjustable control over punch timing and length of stroke.

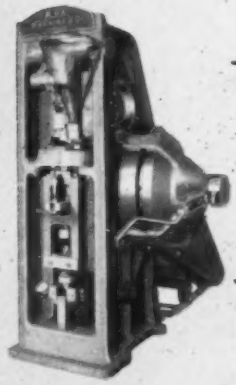
An entire range of sizes and models, both mechanically and hydraulically operated, is available in the KUX family of powder metal presses, a few of which are illustrated at the right.

MODEL 450B

Mechanical — Big 4 Series. 50 tons total pressure . . . tablets up to 6" diameter . . . depth of fill, 3" . . . up to 25 tablets per minute.

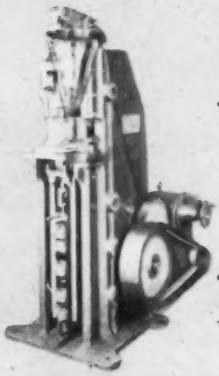
MODEL 65B

Toggle Type Heavy Duty Press. 75 tons total pressure . . . tablets up to 3" diameter . . . depth of fill, either 3" or 3⅞" . . . up to 25 tablets per minute.



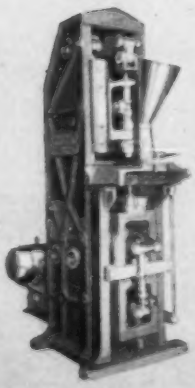
MODEL 64

Multiple Motion Press. 30 tons total pressure . . . tablets up to 3" diameter . . . depth of fill, either 2¼" or 4½" . . . up to 25 tablets per minute.



MODEL 74

Multiple Motion Press. 50 tons total pressure . . . tablets up to 5" diameter . . . depth of fill, either 5½" or 8" . . . up to 15 tablets per minute.



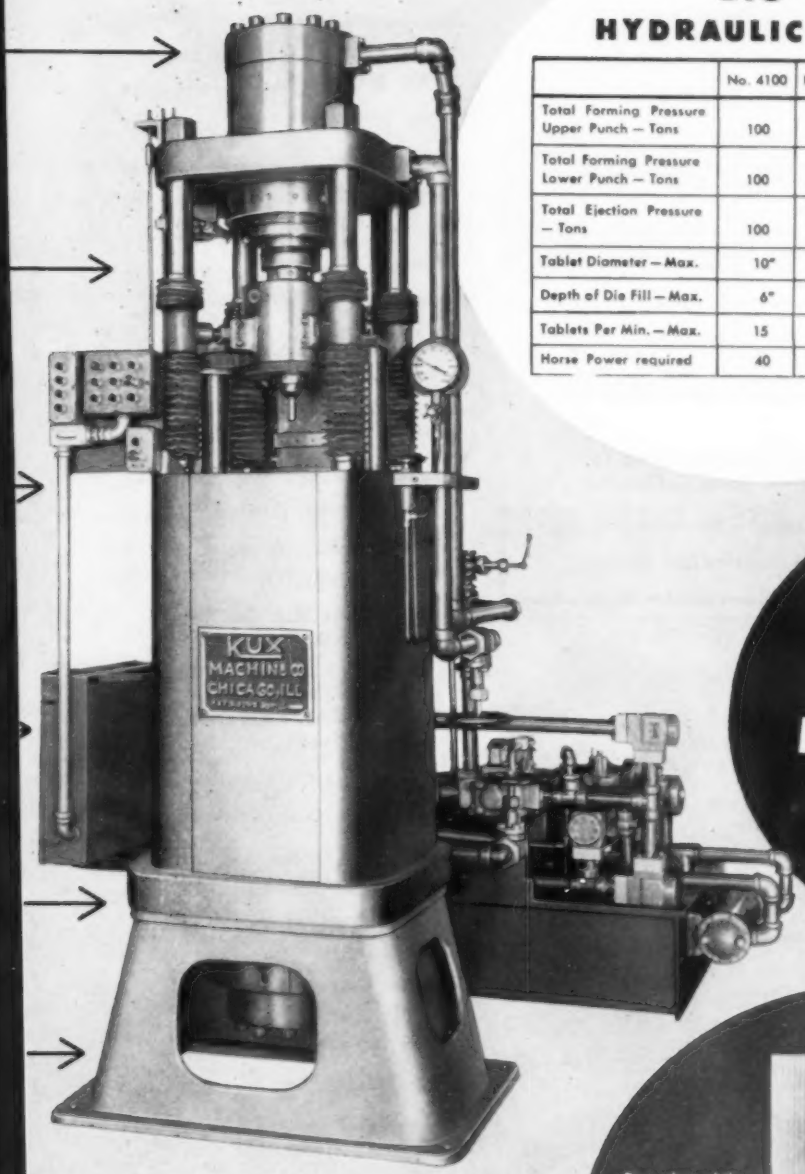
- **FULLY HYDRAULIC** applies pressure to tablet with both upper and lower punches. Lower punch ejects tablet with full forming pressure.
- **COMPLETELY AUTOMATIC** pushbuttons operate machine continuously or through a single cycle with an automatic stop position. Emergency stop control is also provided.
- **ACCURATE DIMENSIONAL THICKNESS OF TABLETS** upper and lower punches come to a positive mechanical stop position, holding the desired thickness of each tablet.
- **ALWAYS TRUE DENSITY** upper and lower punches can be adjusted to come to a hydraulic pressure stop position, applying exact pressure on the tablet to give true density regardless of variation in die fill.
- **PERFECT PUNCH AND DIE ALIGNMENT** take-up bushings on tie bars permit punches and die to be held in perfect alignment.
- **SIMPLE ADJUSTMENT AND LOCKING** of die fill and upper and lower pressure strokes.
- **QUICK, EASY TOOL CHANGEOVERS** because punches, die and core rod mountings are readily accessible.
- **ACCURATE DIE FILLING** with hydraulically operated shuttle-type shoe. Controlled speed of movement.

For more information circle No. 49 on the Reader Service Card

**MODEL 4100—100 TONS TOTAL PRESSURE—
TABLETS UP TO 10″ DIAMETER—6″ MAXIMUM DEPTH OF DIE FILL**

BIG 4
HYDRAULIC MODELS

	No. 4100	No. 4200	No. 4300	No. 4500
Total Forming Pressure Upper Punch — Tons	100	200	300	500
Total Forming Pressure Lower Punch — Tons	100	200	300	500
Total Ejection Pressure — Tons	100	200	300	500
Tablet Diameter — Max.	10″	12″	15″	15″
Depth of Die Fill — Max.	6″	8″	10″	10″
Tablets Per Min. — Max.	15	10	10	8
Horse Power required	40	50	60	100



The Model 4100 is also available with a movable die table and a movable lower core mechanism. The latter can be used even while a stationary core is utilized. Has a full 6-inch stroke and can withstand 40 tons total pressure. Timing mechanism allows movable core rod to operate up or down during any portion of the timing cycle.

KUX
MACHINE CO.

6725 North Ridge Avenue
Chicago 26, Illinois

Rear view of the Model 4100 Press showing hydraulic equipment, the supply hopper and electric panel box.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.
Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

STRUCTURAL PARTS
Iron Base, High Density, Copper Free

American Electro Metal Corp.

Asco Sintering Co.

Bassick Co., The

Bound Brook Oil-less Bearing Co.

Brockway Pressed Metals, Inc.

Burgess-Norton Mfg. Co.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

Ford Motor Co.
Dearborn General Mfg. Div.

General Powdered Metal Products Co., Inc.

Globe Industries
Supermet Div.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Metal Powder Products, Inc.

Michigan Powdered Metal Products Co.

Moraine Products Div.
General Motors Corp.

Parker White-Metal Co.

Picco, Inc.

Powdercraft Corp.

Presmet Corp., The

Pyroferric Co., Inc.

Reese Metal Products Corp.

St. Marys Carbon Co.

Sintered Metals, Inc.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.

Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

STRUCTURAL PARTS
Iron Base, Infiltrated

American Electro Metal Corp.

Asco Sintering Co.

Bound Brook Oil-less Bearing Co.

Burgess-Norton Mfg. Co.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Detroit Sintered Metals Corp.

Dixon Sintaloy, Inc.

Eberhart Steel Products Corp.
PM Division

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

Ford Motor Co.
Dearborn General Mfg. Div.

General Powdered Metal Products Co., Inc.

General Sintering Corp.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Metal Powder Products, Inc.

Michigan Powdered Metal Products Co.

Moraine Products Div.
General Motors Corp.

Parker White-Metal Co.

Picco, Inc.

Powder Metal Products, Inc.

Powdercraft Corp.

Precision Metal Products Co.

Presmet Corp., The

Reese Metal Products Corp.

St. Marys Carbon Co.

Sintered Metals, Inc.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.

Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

STRUCTURAL PARTS
Nickel Silver

Asco Sintering Co.

Bound Brook Oil-less Bearing Co.

Capitol Mfg. Corp.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Henry L. Crowley & Co., Inc.

Dixon Sintaloy, Inc.

Engineered Plastics, Inc.
American Sinterings Div.

Ferro Powdered Metals, Inc.

General Powdered Metal Products Co., Inc.

Indar Corp.

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Keystone Carbon Co.

Kwikset Powdered Metal Products

Merriman Bros., Inc.

Metal Powder Products, Inc.

Moraine Products Div.
General Motors Corp.

National Diamond Laboratory

National Molded Products, Inc.

Parker White-Metal Co.

Picco, Inc.

Powdercraft Corp.

Presmet Corp., The

Reese Metal Products Corp.

Sintered Metals, Inc.

Superior Carbon Products, Inc.

Thompson Products, Inc.
Metallurgical Products Div.

United States Graphite Co., The

Wakefield Bearing Corp.

Watertown Mfg. Co.

Western Sintering Co.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

STRUCTURAL PARTS
Filters

American Electro Metal Corp.
(stainless steel, bronze)

Asco Sintering Co.

Chrysler Corp.
Amplex Div.
(bronze, stainless steel)

Dixon Sintaloy, Inc.
(sintered nylon)

International Powder Metallurgy Co., Inc.

International Powder Metallurgy Co., Inc.
Rocky Mountain Metals Div.

Kwikset Powdered Metal Products
(bronze, stainless steel)

Micro Metallic Corp.
(stainless steel, monel, nickel)

Permanent Filter Corp.

Picco, Inc.
(bronze)

Powdercraft Corp.
(bronze, nickel, iron nickel, silver)

Precision Metal Products Co.

Wakefield Bearing Corp.

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.

For more information circle No. 6 on the Reader Service Card

PRODUCERS OF
ELECTROLYTIC COPPER POWDERS
COPPER BASE ALLOY POWDERS

LOW MELTING POINT ALLOY POWDERS

THE AMERICAN METAL CO. LTD.

- TIN POWDERS
- SOLDER POWDERS
- SILVER, GOLD AND POWDERS OF OTHER PRECIOUS METALS

For Specifications Sheets Write to

THE AMERICAN METAL Co., Ltd.
ROOM 2801 • 61 Broadway, NEW YORK 6, N. Y.

Precision Made . . . For Precision Performance

POWDERED METAL PARTS

precision made from exclusively formulated non-ferrous Sintroloy and Ductiloy are molded to close tolerances, thereby eliminating machining of intricate shape and high scrap loss.

Perhaps we may be able to help you solve specific parts problems. Get in touch with National Molded today for prompt attention.

Write today for detailed information and free literature on cost-saving standard bearings which are available from stock.

NATIONAL MOLDED PRODUCTS, INC.
40-42 S. ST. MARYS ST. • ST. MARYS, PA.

For more information circle No. 63 on the Reader Service Card

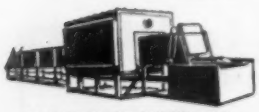
AN OFFER OF HELP WITH YOUR HEAT PROCESSING PROBLEMS

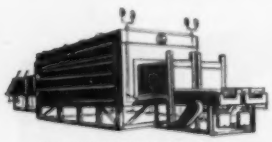
BOX

ELEVATOR

BELL

STRAND ANNEALING


CONTINUOUS MESH BELT CONVEYOR


TWIN AND SINGLE MUFFLE PUSHER

WRITE FOR YOUR PERSONAL COPY

of new Pictorial Review of Harper Specially Designed Furnaces

For

Continuous Brazing
Bright Annealing
Sintering Powder Metals
High Speed Steel Heat Treating
Billet and Bar Heating
Annealing
Melting in Crucibles
Forging
General Heat Treating

• **HERE AT HARPER,** the case history of your installation is written *before* you place your order!

The men of Harper believe in and work on this principle—you get the best results at lowest cost with high temperature electric furnaces specially designed and built to fit your products.

Isn't that better than trying to adapt your work to the furnaces? We call it "The Harper Way" and it works!

You need feel no hesitancy in leaning on Harper specialized *but broad* experience in developing electric furnaces for processing today's new metals and alloys—with or without special atmospheres.

The sketches show just a few types of Harper furnaces that are helping manufacturers gain a competitive edge through advanced design, volume production and lower costs.

Your request for a discussion is bound to spark-plug some worthwhile sharing of up-to-date thinking.

P.S. *You will not find us "high pressure".*

Furnace Builders for over 30 Years

HARPER

Electric Furnace Corp.

41 RIVER ST., BUFFALO 2, N. Y.

Representatives in Principal Cities

For more information circle No. 38 on the Reader Service Card

STRUCTURAL PARTS
Miscellaneous

American Electro Metal Corp.
(stainless steel)

Asco Sintering Co.
(Copper-lead)

Chrysler Corp.
Amplex Div.
(stainless steel)

Dixon Sintaloy, Inc.
(nylon)

Engineered Plastics, Inc.
American Sinterings Div.
(steel)

Indar Corp.
(bronze)

Keystone Carbon Co.
(stainless steel, alloy steel, aluminum)

Merriman Bros., Inc.

Reese Metal Products Corp.
(nickel-copper)

Sintered Metals, Inc.
(nylon)

Superior Carbon Products, Inc.
(silver)

United States Graphite Co., The

Yale & Towne Mfg. Co., The
Powdered Metal Products Div.
(stainless steel)

EQUIPMENT SUPPLIERS

DIES AND TOOLS

Carborundum Co., The
(metal bonded diamond wheels)

Champion Tool & Die Co.
(cemented carbide dies, special core rods and punches)

Cleveland Tool & Die Co.
(carbide dies, tools & core rods)

Arthur Colton Co.
(special core rods and punches)

Curtis Carbide Die Co.
(cemented carbide dies)

Diecraft Tool Co.
(carbide dies & tools)

Elizabeth Carbide Die Co., Inc.
(carbide dies and tools)

Firth Sterling, Inc.
(cemented carbide dies, special core rods and punches)

General Electric Co.
Carboloy Dept.
(cemented carbide dies)

Koebel Diamond Tool Co.
(diamond tools)

Micro-Carbide Tool & Die Co., Inc.
(cemented carbide dies, special core rods and punches)

Monarch Tool & Gauge Co.
(cemented carbide dies, special core rods and punches)

National Carbide Die Co.
(cemented carbide dies, special core rods and punches)

National Diamond Laboratory
(special core rods and punches, diamond tools)

John E. Skach Tool Co.
(powder metal tooling only)

F. J. Stokes Machine Co., Inc.
(cemented carbide dies, special core rods and punches)

Windsor Diamond Tool Co.
(diamond tools)

FURNACES, ELECTRIC

Abbot Corp.

Ajax Electrothermic Corp.

Continental Industrial Engineers, Inc.

Drever Co.

Electric Furnace Co., The

Falcon Equipment Co.

Ferguson Equipment Corp.

Gas Machinery Co., The

General Electric Co.
Apparatus Sales Div.

Claud S. Gordon Co.

Harper Electric Furnace Corp.

C. I. Hayes, Inc.

Hevi-Duty Electric Co.

Holcroft & Co.

A. Johnson & Co., Inc.

Leeds & Northrup Co.

Lindberg Engineering Co.

Lithium Co., The

Pereny Equipment Co.

Posey Iron Works, Inc.
Industrial Heating Div.

Sargeant & Wilbur, Inc.

Sentry Co., The

Sunbeam Corp.
Industrial Furnace Div.

Taunton Engineering Works

Westinghouse Electric Corp.

FURNACES, FUEL FIRED

Abbot Corp.

Continental Industrial Engineers, Inc.

Drever Co.

Eclipse Fuel Engineering Co.

Electric Furnace Co., The

Ferguson Equipment Corp.

Gas Machinery Co., The

Claud S. Gordon Co.

Holcroft & Co.

Lindberg Engineering Co.

Lithium Co., The

Pereny Equipment Co.

Posey Iron Works, Inc.
Industrial Heating Div.

Sargeant & Wilbur, Inc.

Sunbeam Corp.
Industrial Furnace Div.

Surface Combustion Corp.

Westinghouse Electric Corp.

GAS GENERATORS FOR CONTROLLED ATMOSPHERES

Anhydrous Ammonia

Allied Chemical & Dye Corp.
Barrett Div.

Apothecaries Hall Co.

Armour & Co.
Ammonia Div.

Henry Bower Chemical Mfg. Co.

E. I. du Pont de Nemours & Co.
Polychemicals Div.

Hamler Industries, Inc.

Matheson Co., Inc.

Mathieson Chemical Corp.

Midland Ammonia Co.

Monsanto Chemical Co.

Dissociated Ammonia

Continental Industrial Engineers, Inc.

Drever Co.

Electric Furnace Co., The

Claud S. Gordon Co.

C. I. Hayes, Inc.

Hevi-Duty Electric Co.

Lindberg Engineering Co.

Lithium Co., The

Sargeant & Wilbur, Inc.

Sunbeam Corp.
Industrial Furnace Div.

Surface Combustion Corp.

Westinghouse Electric Corp.

Partially Combusted (Endo-Thermic) Gas

Continental Industrial Engineers, Inc.

Electric Furnace Co., The

Ferguson Equipment Corp.

Claud S. Gordon Co.

C. I. Hayes, Inc.

Hevi-Duty Electric Co.

Holcroft & Co.

Lindberg Engineering Co.

Lithium Co., The

Sargeant & Wilbur, Inc.

Sunbeam Corp.
Industrial Furnace Div.

Surface Combustion Corp.

Westinghouse Electric Corp.

Completely Combusted (Exo-thermic) Gas

Continental Industrial Engineers, Inc.

Electric Furnace Co., The

Ferguson Equipment Corp.

Claud S. Gordon Co.

C. I. Hayes, Inc.

Hevi-Duty Electric Co.

Holcroft & Co.

C. M. Kemp Mfg. Co., The

Lindberg Engineering Co.

Lithium Co., The

Sargeant & Wilbur, Inc.

Sunbeam Corp.
Industrial Furnace Div.

Surface Combustion Corp.

Westinghouse Electric Corp.

Liquid Hydrocarbon Decomposition

Continental Industrial Engineers, Inc.

Electric Furnace Co., The

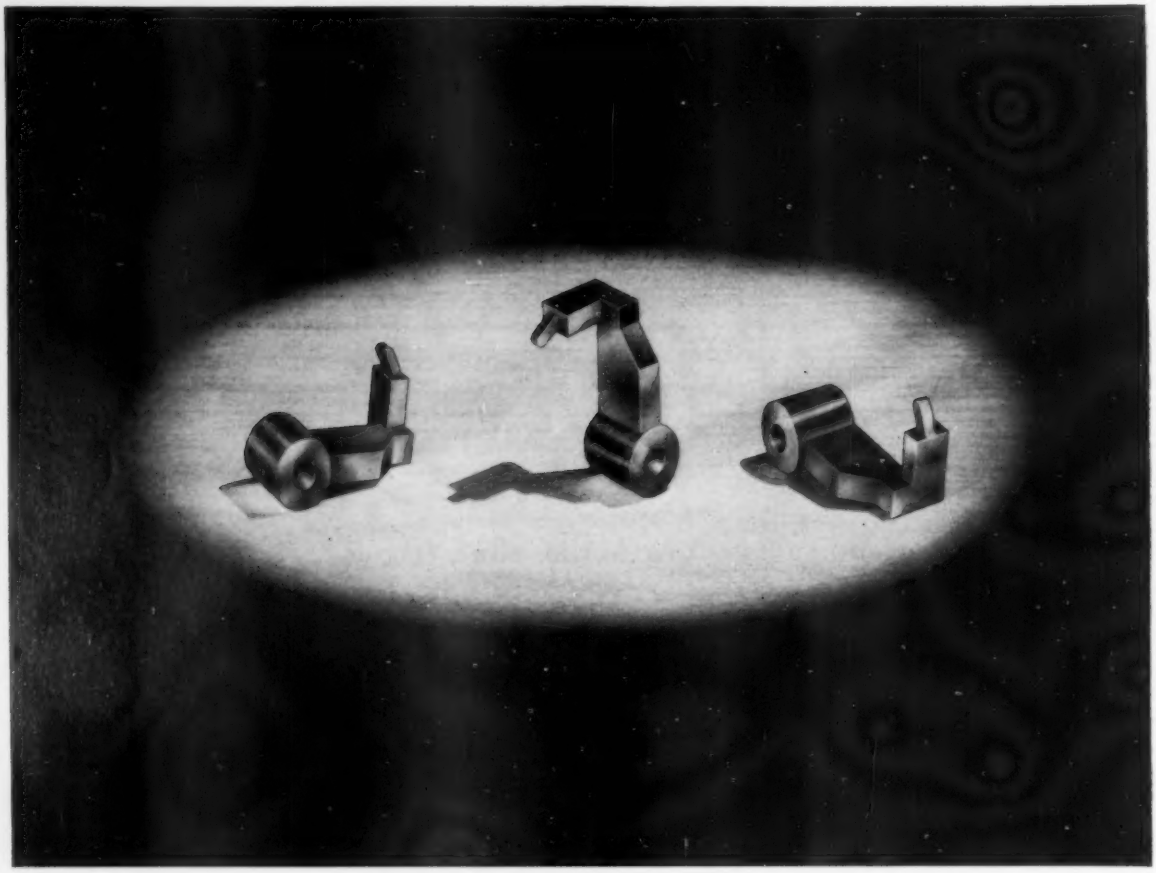
Claud S. Gordon Co.

Hevi-Duty Electric Co.

Lithium Co., The

Sargeant & Wilbur, Inc.

Surface Combustion Corp.



Impossible in Powdered Metal? Not at PARKER

PARKER
SALES ENGINEERS

CHICAGO 49, Ill.
Ollie J. Berger Company • 2059 East 72 Street

CINCINNATI, Ohio
William H. Brasterman • 2174 Buck Street

DETROIT 35, Mich.
Hodgson-Geisler Co. • 18917 James Couzens

GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F. Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

This part—with projections in several planes, not to mention an I.D.-O.D. section—looked like an impossible job for powdered metal. Yet Parker made it in **one press operation**—complete—to close tolerances and tight "specs"—at relatively **low cost.**

This unusual piece points up the advantages offered by Parker powdered metal processing. Tough cost problems of conventional casting and machining methods often can be solved. Tensile strength, ductility and impact resistance can be closely controlled to meet rigid specifications. Powdered metal constituents can be precisely and uniformly blended for a wide range of requirements.

Parker's experience and facilities in producing a wide variety of powdered metal parts have saved money—and solved problems—for many users. Your problem may be one that Parker can solve in like manner. Just call the nearest Parker sales engineer listed at the left.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER

POWDERED METAL PARTS
ALUMINUM and ZINC
die castings

For more information circle No. 69 on the Reader Service Card

Other Types

Continental Industrial Engineers, Inc.

Electric Furnace Co., The

Holcroft & Co.

Lithium Co., The

Sargeant & Wilbur, Inc.

IMPREGNATION EQUIPMENT FOR SEALING POROUS PARTS

American Metaseal Mfg. Corp.

Multiplastics

F. J. Stokes Machine Co., Inc.

Tincher Products Co.

LABORATORY CONTROL & INSPECTION EQUIPMENT

A. Daigger & Co.
(metallographic equipment and supplies)

Federal Classifier Systems, Inc.
(laboratory and commercial air separators)

Haller, Inc.
(strength testing equipment, hand dies for MPA Std. bars and bushings)

Sturtevant Mill Co.
(Jaw Crushers, Crushing Rolls)

LUBRICANTS
Powder Lubricants

Acheson Industries, Inc.
Acheson Colloids Co. Div.
("dag" colloidal graphite)

American Cyanamid Co.
Metal Chemicals Section
(metallic stearates)

Capital City Products Co., The
(sterotex)

Foote Mineral Co.
(lithium stearate)

Leffingwell Chemical Co.
(zinc, magnesium, lithium, calcium stearates)

Nopco Chemical Co.
(zinc, magnesium, calcium stearates)

M. W. Parsons-Plymouth, Inc.
(zinc, calcium, lithium stearates)

Sun Chemical Corp.
Warwick Chemical Co. Div.
(metallic stearates)

Whittaker, Clark & Daniels, Inc.
(aluminum, calcium, lithium stearates)

Witco Chemical Co.
(zinc, calcium stearates)

LUBRICANTS
Die Lubricants

Acheson Industries, Inc.
Acheson Colloids Co. Div.
("dag" dispersions of colloidal graphite, vermiculite, molybdenum disulfide, mica)

Capital City Products Co., The
(Sterotex)

MIXING & BLENDING EQUIPMENT

Abbe Engineering Co.
(double cone)

R. N. Bailey & Co., Inc.
(double cone, spiral flight)

Cleveland Mixer Co., The
(double cone, spiral flight)

Arthur Colton Co.
(spiral flight)

A. Daigger & Co.
(double cone)

J. H. Day Co., Inc., The
(spiral flight)

W. J. Fitzpatrick Co., The

Industrial Products Engineering Co.
(double cone, spiral flight)

International Engineering, Inc.
(double cone)

National Engineering Co.
Simpson Mix-Muller Div.

Read Standard Corp.
(spiral flight)

Robinson Mfg. Co.
(double cone, spiral flight)

J. W. Runge & Co.
(double cone, spiral flight)

Sturtevant Mill Co.

Taunton Engineering Works
(double cone, spiral flight)

PRESSES, HYDRAULIC

American Steel Foundries
Elmes Engineering Div.

Baldwin-Lima-Hamilton Corp.

E. W. Bliss Co.

Clifton Hydraulic Press Co.

Arthur Colton Co.

Dennison Engineering Co.

Haller, Inc.

Hannifin Corp.

Hydropress, Inc.

Kux Machine Co.

Lake Erie Engineering Corp.

Logan Engineering Co.

Loomis Engineering & Mfg. Co.

M & N Hydraulic Press Co.

Oliver Corp., The
A. B. Farquhar Div.

Standard Machinery Co.

F. J. Stokes Machine Co., Inc.

PRESSES, MECHANICAL

E. W. Bliss Co.

Arthur Colton Co.

Haller, Inc.

A. Johnson & Co., Inc.

Johnson Machine & Press Corp.

Kux Machine Co.

Minster Machine Co., The

F. J. Stokes Machine Co., Inc.

Walsh Press & Die Co.

PYROMETERS & PYROMETRIC EQUIPMENT
Millivoltmeter Type

Barber-Colman Co.
Wheelco Instruments Div.
(indicating, recording)

R. A. Ekstrom Co.
(indicating, recording)

General Electric Co.
Apparatus Sales Div.
(indicating, recording)

Claud S. Gordon Co.
(indicating, recording)

Illinois Testing Labs, Inc.
(indicating)

Minneapolis-Honeywell Regulator Co.
Brown Instrument Div.
(indicating)

Pereny Equipment Co.
(indicating, recording)

Pyrometer Instrument Co., Inc., The
(indicating, recording)

Arklay S. Richards Co., Inc.
(indicating)

Simpson Electric Co.

West Instrument Corp.
(indicating)

Potentiometer Type

Barber-Colman Co.
Wheelco Instruments Div.
(recording)

General Electric Co.
Apparatus Sales Div.
(indicating, recording)

Claud S. Gordon Co.
(indicating, recording)

Illinois Testing Labs, Inc.
(indicating)

Leeds & Northrup Co.
(indicating, recording)

Pereny Equipment Co.
(indicating, recording)

Pyrometer Instrument Co., Inc., The
(indicating, recording)

West Instrument Corp.
(indicating, recording)

Thermocouples

Barber-Colman Co.
Wheelco Instruments Div.

R. A. Ekstrom Co.

General Electric Co.
Apparatus Sales Div.

Claud S. Gordon Co.

Illinois Testing Labs, Inc.

Leeds & Northrup Co.

Minneapolis-Honeywell Regulator Co., Brown Instrument Div.

Pereny Equipment Co.

Pyrometer Instrument Co., Inc. The

Arklay S. Richards Co., Inc.

Service Associated, Inc.

West Instrument Corp.

Winslow Co., Inc., The

Compensating Lead Wire

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West Instrument Corp.

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Wheelco Instruments Div.

R. A. Ekstrom Co.

General Electric Co.
Apparatus Sales Div.

Claud S. Gordon Co.

Illinois Testing Labs, Inc.

Leeds & Northrup Co.

Minneapolis-Honeywell Regulator Co., Brown Instrument Div.

Pyrometer Instrument Co., Inc. The

Arklay S. Richards Co., Inc.

Service Associated, Inc.

West Instrument Corp.

Program Controllers

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Wheelco Instruments Div.

R. A. Ekstrom Co.

Claud S. Gordon Co.

Leeds & Northrup Co.

Pereny Equipment Co.

West Instrument Corp.

Thermocouple Failure Protective Devices

Barber-Colman Co.
Wheelco Instruments Div.

R. A. Ekstrom Co.

Claud S. Gordon Co.

Illinois Testing Labs, Inc.

Pereny Equipment Co.

West Instrument Corp.

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Wheelco Instruments Div.

Eclipse Fuel Engineering Co.

R. A. Ekstrom Co.

For more information circle No. 27 on the Reader Service Card

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Illinois Testing Labs, Inc

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Claud S. Gordon Co.

Leeds & Northrup Co.

Pyrometer Instrument Co., Inc., The

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Republic Flow Meters Co.
(combustion control equipment)

Arklay S. Richards Co., Inc.
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Service Associated, Inc.
(overtemperature limit fuses)

Winslow Co., Inc., The

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(industrial)

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(industrial)

Exolon Co., The
(industrial and laboratory)

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(industrial)

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(industrial and laboratory)

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Belmont Smelting & Refining Works, Inc.

Charles Hardy, Inc.

Metals Disintegrating Co., Inc.

Reade Mfg. Co., Inc.

Reynolds Metals Co.

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Belmont Smelting & Refining Works, Inc.
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Charles Hardy, Inc.
(80-20, 70-30, 60-40, 90-10, 85-15, 75-25, 50-50)

Malone Metal Powders, Inc.
(80-20)

Metals Disintegrating Co., Inc.
(80-20, 70-30, 60-40)

New Jersey Zinc Co., The
(80-20, 70-30, 60-40, 90-10, **85-15, 75-25, 50-50)**

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American Metal Co., Ltd., The
(electrolytic, copper base alloy powders)

Belmont Smelting & Refining Works, Inc.
(electrolytic, atomized)

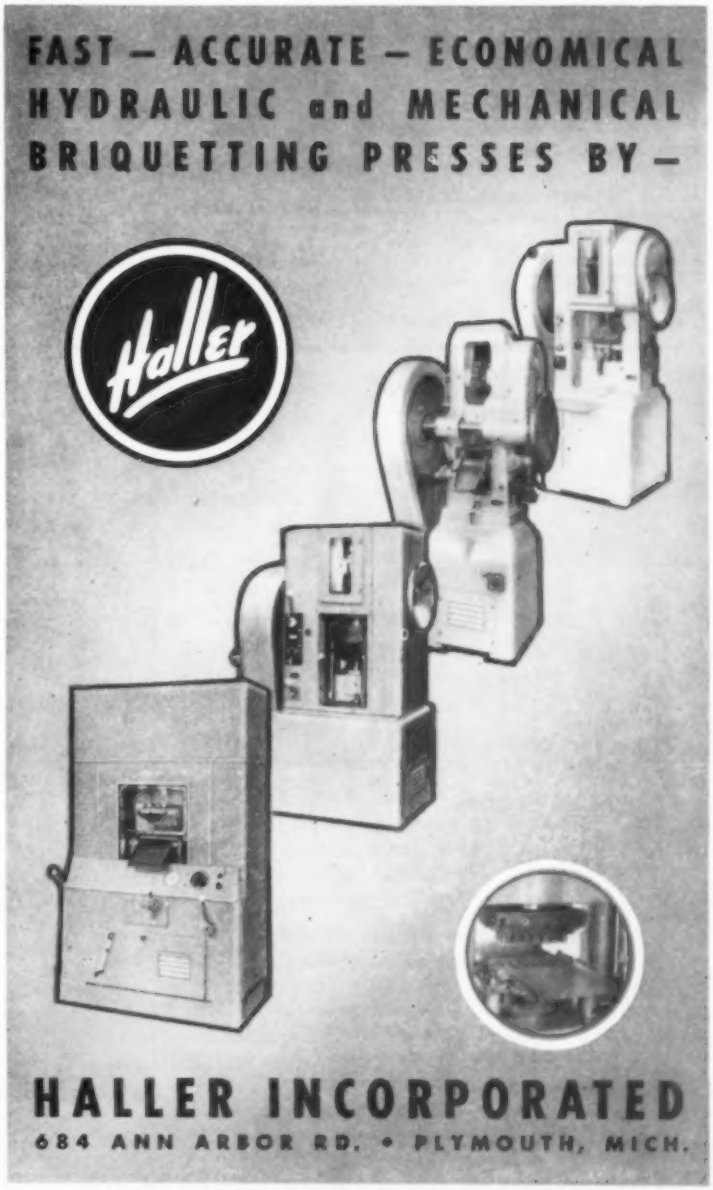
Glidden Co., The
Chemicals-Pigments-Metals Div.
(atomized, hydrogen reduced)

Greenback Industries, Inc.
(sponge)

Charles Hardy, Inc.
(electrolytic, atomized spherical)

Malone Metal Powders, Inc.
(atomized, dendritic)

Metals Disintegrating Co., Inc.
(atomized, reduced from electrolytic)



For more information circle No. 107 on the Reader Service Card

New Jersey Zinc Co., The (atomized)

Whitaker Metals Corp. (precipitated, hydrogen reduced)

IRON

Alan Wood Steel Co. (sponge)

Belmont Smelting & Refining Works, Inc. (sponge, hydrogen reduced, atomized, decarburized cast iron)

Easton Metal Powder Co., Inc. (atomized)

Ekstrand & Tholand, Inc. (sponge)

Ferrum Limited (sponge, atomized)

Charles Hardy, Inc. (sponge, hydrogen reduced, atomized, electrolytic, carbonyl)

A. Johnson & Co., Inc. (electrolytic)

Magnetic Powders, Inc. (hydrogen reduced, carbonyl, annealed)

Metal Powders Limited (sponge)

Metals Disintegrating Co., Inc. (special)

National Radiator Co., The Plastic Metals Div. (sponge, electrolytic)

Pyron Corp. (hydrogen reduced, electrolytic)

Republic Steel Corp. Alloy Div. (hydrogen reduced)

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Belmont Smelting & Refining Works, Inc.

Glidden Co., The Chemicals-Pigments-Metals Div.

Charles Hardy, Inc.

Metals Disintegrating Co., Inc.

National Radiator Co., The Plastic Metals Div.

National Lead Co.

NICKEL

Belmont Smelting & Refining Works, Inc.

Charles Hardy, Inc.

Metals Disintegrating Co., Inc.

National Radiator Co., The Plastic Metals Div.

Pyron Corp.

NICKEL SILVER

Belmont Smelting & Refining Works, Inc.

Charles Hardy, Inc.

Metals Disintegrating Co., Inc.

New Jersey Zinc Co., The

Reade Mfg. Co., Inc.

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Firth Sterling, Inc.

Charles Hardy, Inc.

Metal Powders Limited

National Radiator Co., The Plastic Metals Div.

Vanadium-Alloys Steel Co.

Low Alloy

Belmont Smelting & Refining Works, Inc.

Firth Sterling, Inc.

Charles Hardy, Inc.

Metal Powders Limited

National Radiator Co., The Plastic Metals Div.

Pyron Corp.

Vanadium-Alloys Steel Co.

High Alloy

Charles Hardy, Inc.

Vanadium-Alloys Steel Co.

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Micronized Metals, Inc.

Uniworld Research Corp. of America

Vanadium-Alloys Steel Co.

TIN

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Belmont Smelting & Refining Works, Inc.

Greenback Industries, Inc.

Charles Hardy, Inc.

Metals Disintegrating Co., Inc.

National Lead Co.

Reade Mfg. Co., Inc.

ZINC

Belmont Smelting & Refining Works, Inc.

Charles Hardy, Inc.

Metals Disintegrating Co., Inc.

New Jersey Zinc Co., The

Reade Mfg. Co., Inc.

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(copper base alloy powders, solder powders)

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(tungsten, molybdenum, tantalum)

Firth Sterling, Inc.
(carbides)

Foote Mineral Co.
(ferro alloys)

Greenback Industries, Inc.
(copper-tin alloy powder)

Charles Hardy, Inc.
(most other metals)

Magnetic Powders, Inc.
(magnetites)

Metal Hydrides, Inc.
(prealloyed powders for addition to iron, produced to specification)

Metals Disintegrating Co., Inc.
(most other metals)

National Radiator Co., The Plastic Metals Div.
(manganese, silicon, ferro alloys)

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(eutectic phos-copper, prealloyed bronze)

Reade Mfg. Co., Inc.
(magnesium, magnesium alloys)

Shieldalloy Corp.
(metal carbides, chromium, tantalum, columbium)

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(tungsten, molybdenum)

United International Research, Inc.
(titanium)

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(tool steels, high temperature alloys)

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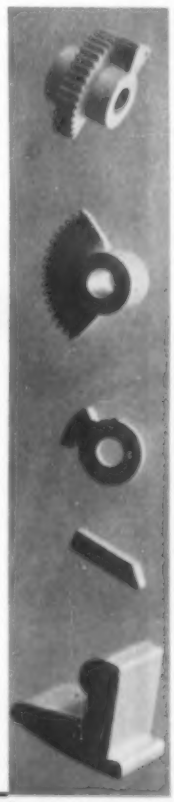

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4th annual

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SECTION 3
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(cemented carbides)

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Nashville, Tenn.
(cores)

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Sintermet Div.
5400 W. 130
Cleveland, O.
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(bearings, structural parts, magnetic materials, cemented carbides, filters)

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North Haven, Conn.
(bearings, structural parts)

Arnold Engineering Co., The
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Marengo, Ill.
(cores, magnetic materials)

Asco Sintering Co.
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Los Angeles, Cal.
(bearings, structural parts, magnetic materials, electrical components, filters)

Bassick Co., The
437 Howard
Bridgeport, Conn.
(bearings, structural parts)

Bound Brook Oil-less Bearing Co.
Lincoln Blvd.
Bound Brook, N.J.
(bearings, structural parts)

Brockway Pressed Metals, Inc.
921 Clark
Brockway, Pa.
(bearings, structural parts)

Burgess-Norton Mfg. Co.
737 Peyton
Geneva, Ill.
(structural parts)

Capitol Mfg. Corp.
22nd & Hervey
North Chicago, Ill.
(bearings, structural parts, magnetic materials, electrical components)

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417 W. Chestnut
Monrovia, Cal.
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Schiller Park, Ill.
(bearings, structural parts, electrical components)

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Amplex Div.
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Detroit, Mich.
(bearings, structural parts, friction materials, electrical components, filters)

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West Orange, N. J.
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Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
Detroit, Mich.
(bearings, structural parts, magnetic materials, electrical components)

Dixon Sintaloy, Inc.
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Stamford, Conn.
(bearings, structural parts, filters, electrical components)

Eberhart Steel Products Corp.
PM Division
1312 N. Division
Mishawaka, Ind.
(bearings, cores, magnetic materials, electrical components)

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American Sinterings Div.
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North Chicago, Ill.
(contact materials)

Ferro Powdered Metals, Inc.
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Salem, Ind.
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Saugerties, N. Y.
(cores, magnetic materials)

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Dearborn General Mfg. Div.
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Dearborn, Mich.
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Carboloy Dept.
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Detroit, Mich.
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Akron, O.
(friction materials)

General Powdered Metal Products Co., Inc.
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(bearings, structural parts, magnetic materials, electrical components)

General Sintering Corp.
3907 Wesley Terrace
Schiller Park, Ill.
(bearings, structural parts, magnetic materials, electrical components)

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8436 Frankstown Ave.
Pittsburgh, Pa.
(contact materials)

Globe Industries
Supermet Div.
1460 Cincinnati
Dayton, O.
(structural parts)

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Indianapolis, Ind.
(bearings, structural parts, cores, magnetic materials, electrical components)

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Vaparaiso, Ind.
(magnetic materials)

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Ridgway, Pa.
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Jamaica Plain, Mass.
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Logan, O.
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North Arlington, N. J.
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Northville, Mich.
(bearings, structural parts, electrical components)

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Brooklyn, N. Y.
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Pyroferric Bldg.
New York, N. Y.
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St. Marys, Pa.
(cores)

Radio Cores, Inc.
9540 Tulley Ave.
Oak Lawn, Ill.
(cores)

Raybestos-Manhattan, Inc.
61 Willett
Passaic, N. J.
(friction materials)

Reese Metal Products Corp.
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Lancaster, Pa.
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(bearings, structural parts)

Sintercast Corp. of America
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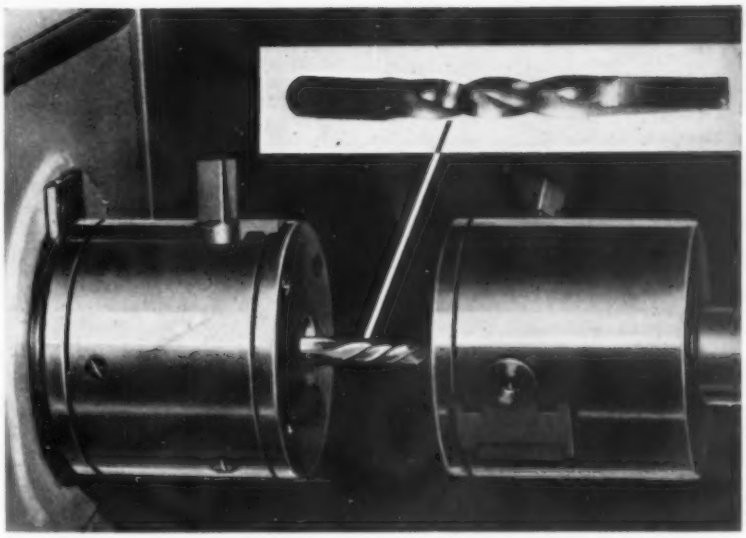
(cemented carbides)



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Metallurgical Products Div.
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Cleveland, O.
(bearings, structural parts, electrical components)

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Saginaw, Mich.
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(bearings, structural parts, friction materials, filters)

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Watertown, Conn.
(bearings, structural parts, electrical components)

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Clifton, N. J.
(cemented carbides)

S. K. Wellman Co., The
200 Egbert Rd.
Bedford, O.
(friction materials)

Wesson Metal Corp.
Lexington, Ky.
(cemented carbides)

Western Sintering Co.
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(bearings, structural parts)

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Allied Chemical & Dye Corp.
Barrett Div.
42 Rector
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(gas generators)

Alloy Engineering Co., The
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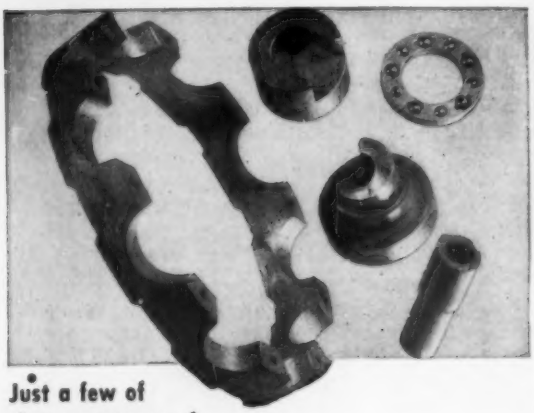
Eddystone, Pa.
(hydraulic presses)



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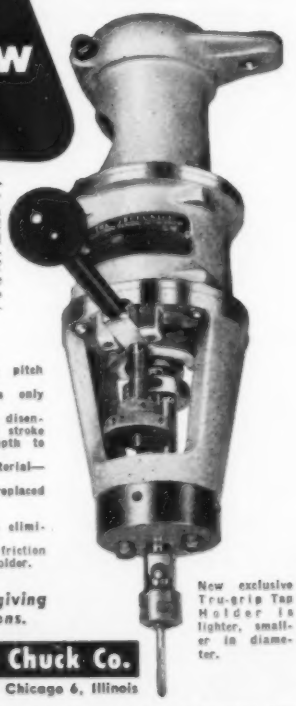

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For more information circle No. 105 on the Reader Service Card

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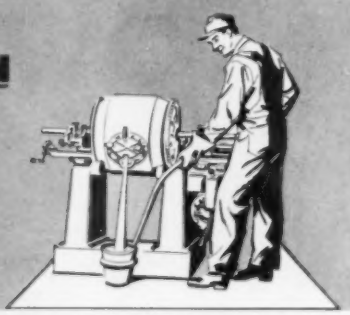

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National Diamond Laboratory
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Chicago, Ill.
(mixing and blending equipment)

Nopco Chemical Co.
First & Essex Sts.
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Chicago, Ill.
(pyrometers)

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(dies and tools)

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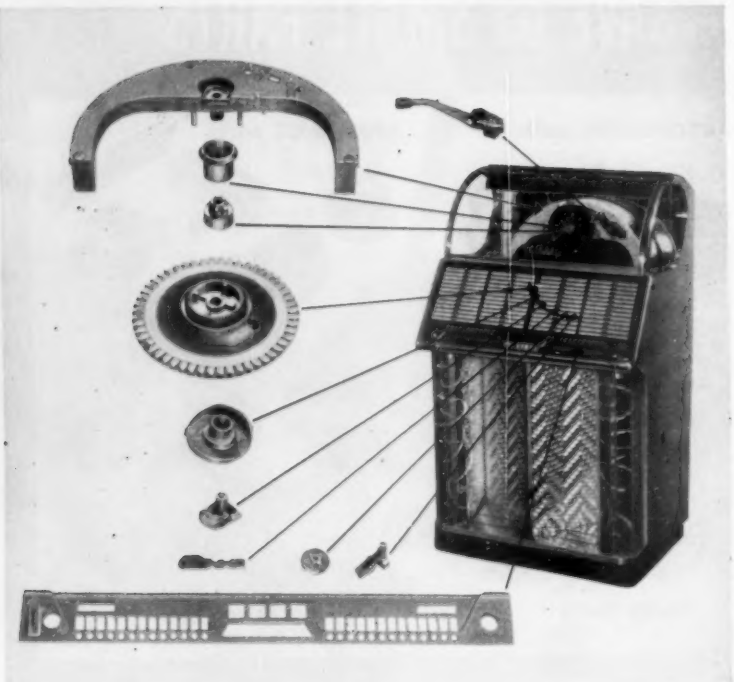

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Foote Mineral Co.
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Glidden Co., The.
Chemicals-Pigments-Metals Div.
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Cleveland, O.
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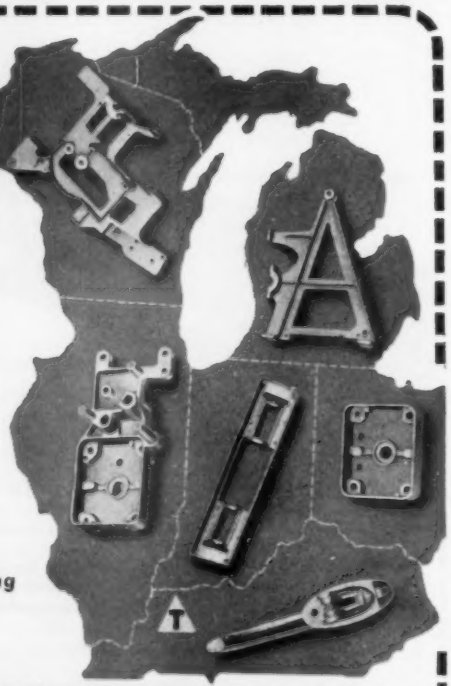

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For more information circle No. 86 on the Reader Service Card

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National Radiator Co., The
Plastic Metals Div.
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Alloy Div.
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Massillon, O.
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Long Island City, N. Y.
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Uniworld Research Corp. of America
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(hard facing powders)

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(carbides)

Whitaker Metals Corp.
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(copper)

NEWS OF INDUSTRY AND ASSOCIATIONS

E. C. BLOOMBERG ELECTED MONARCH ALUMINUM HEAD

The election of Edward C. Bloomberg as president of Monarch Aluminum Mfg. Company, Cleveland, Ohio has been announced by the board of directors. His election fills the office left vacant by the death of Raymond Deutsch, February 27th.

Mr. Bloomberg, who is 44 years of age, has actively participated in the general management of the company during the past 12 years.

E. C. Bloomberg

He joined Monarch in 1943 after resigning as vice president of The Ideal Furniture Co., Charleston, W. Va. He was elected treasurer of Monarch in 1947 and one year later was elected executive vice president and treasurer.

Mr. Bloomberg's participation in industrial and civic activities include the Aluminum Association, in which he is chairman of the Aluminum & Health Committee and serves on the Public Relations Committee. He is a member of the Aluminum Wares Association, American Ordnance Association, Armed Forces Chemical Association and the American Die Casting Institute.

GLIDDEN BUYS ZAPON

Purchase of assets of the Zapon Industrial Finishes Division of the Atlas Powder Co. of Wilmington, Del. by The Glidden Co. has been announced by Dwight P. Joyce, Glidden president and board chairman.

The acquisition includes all notes and accounts receivable, patents, formulas, trademarks, certain specialized equipment and the sales and technical staffs of the Zapon Division. Glidden reports that the Zapon addition will boost the firm's industrial coating business significantly.

The transfer is effective immediately, the new unit will operate as the Zapon Industrial Coatings Division of The Glidden Company.

RAMPE MOVES AGAIN

The Rampe Manufacturing Co., producers of tumbling and burring machines, have enlarged their factory space for the second time in three years. Their first move was to open a second factory three years ago, but they now have found it necessary to expand into a new plant with double the combined floor space of the two old plants. Address of Rampe's new plant is 14915 Woodworth Ave., Cleveland 10, Ohio.

MIDWEST PRECISION MOVES

Midwest Precision Casting Co., Cleveland, has moved from 2790 Grand Ave. to larger, improved facilities at 10703-09 Quincy Ave., according to an announcement released by William Julian, vice president of the company.

The new quarters consist of an office, engineering department and foundry building.

For the past seven years, Midwest Precision Castings Company has produced castings in all metals by the lost wax process.

SOCIETY OF DIE CASTING ENGINEERS ORGANIZED

A new technical society, named the Society of Die Casting Engineers, has been formed to foster technological advances in the field of die casting and finishing of metals and die molding of plastics and powdered metals.

The main objective reported by the new society will be the exchange, accumulation and dissemination of information on die casting and related arts. A major aim is the development of modern standards for the die casting industry.

The first chapter to be formed within the new organization is the Detroit No. 1 Chapter. Officers for 1955 are: president, Harris Shimel of Chevrolet-Bay City; vice president, Marshall Aberle of H & M Industries; secretary, George Griffenham of Mergraf Oil Co.; recording secretary, John Lapin of Saginaw Bay Industries; treasurer, Arthur Tinetti of A.C. Spark Plug; librarian and historian, Mike Tenenbaum of Lester Phoenix Machine Co.; and trustees, Harry Ericksen of A.C. Spark Plug, Herbert Roushkolb of Cleveland Automatic Machine Co., and John Miller of H & M Industries.

Membership is open to those whose business activities relate to die casting, die molding, finishing and related arts. The society's national headquarters and offices will be located at 19370 James Couzens Highway, Detroit 35.

OPPORTUNITIES

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WANT TO BUY late used aluminum die casting machine about 8 cavity capacity for small parts 3½" x 2½". Write Box 5155 PRECISION METAL MOLDING magazine.

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MACHINE DESIGNERS — Die Casting Equipment — As a result of an expansion program of large Midwestern Machine Tool Manufacturer, engineers experienced in die casting machine design and development are needed. Top job available for right man. Write Box 5355 PRECISION METAL MOLDING.

SALES ENGINEER — Die Casting Equipment — Large established manufacturer of die casting machinery wants sales engineers experienced in die casting process and equipment. Write Box 5455 PRECISION METAL MOLDING magazine.

OPPORTUNITY FOR METALLURGIST with some powdered metal experience. An unusual opportunity for growth for the right man to work in the capacity of Assistant to the Chief Metallurgist of a large eastern powdered metal parts' fabricator. Please send complete resume. Write Box 5555 PRECISION METAL MOLDING magazine.

OLD ESTABLISHED VOLUME DIE CASTERS in Southern California has fine opportunity for man with plenty of experience and know-how in Investment Casting by lost wax method. Must be one willing to take coat off and get hands dirty but with ability to grow with this new department. State background, experience, qualifications and salary to start. Confidential. Write Box 5655 PRECISION METAL MOLDING magazine.

WILL BUY discarded die casting molds suitable for manufacturing housewares, hardware, door and window fittings in 400 ton Cleveland. Write "IMUSA" Apartado Aereo 1237 — Medellin — Columbia — S. A.

WANTED — All types of die casting machinery, late or old, small or large. Barr Machinery Company, 817 West Lake Street, Chicago, Illinois.

SALES REPRESENTATIVE WANTED — for large brass, bronze and aluminum permanent mold foundry for territories handled out of Indianapolis, Indiana and Pittsburgh, Pennsylvania. Give all details on self in first letter. Alcaloy, Inc., P. O. Box 503, Trenton, New Jersey.

FOR SALE: Lester HHP-3XS 600 ton aluminum die casting machine approximately a year old and little used. Many extras still new. Would consider Cleveland $400 aluminum machine in exchange. Magnesium Industries, Inc., South Haven, Michigan.

DIE CASTING EQUIPMENT FOR IMMEDIATE SALE

(1) No. 2 Hydrocast Cold Chamber Vertical Die Casting machine (Hydropress HPO-19590); Weight 14,300 lbs.; 440 volts, 60 cycle, 3 phase; 200 cycles per hour. Note: This machine unused since being completely reconditioned by factory erection specialists, including lines, hydraulic pumps, motors and all functional mechanisms.

(1) Lindberg-Fisher Type ADC-250 Stationary Crucible Melting Furnace; crucible capacity 250 lbs., aluminum complete with burners, manifolds and pilot burners.

(1) Crucible for above furnace.

(1) Combustion Air Blower — Lindberg Type A-101-0102, complete with 1 H.P. motor, 220-440 volts, 3 phase, 60 cycle, 3500 R.P.M. and motor starter with pushbutton.

(1) Thermocouple, angle type, and lead wire.

(1) Motorized Air Valve, 25-4M, complete with linkage and Barber Colman motor. The above equipment may be inspected at storage premises in Hastings. PRICE $7,000. Terms are cash on delivery; arrangements and cost of handling and transportation to be borne by buyer. Contact Mr. R. V. Van De Vanter, Chief Engr., Orchard Industries, Inc., Hastings, Michigan.

SALES REPRESENTATIVE WANTED — In New England, New York and Philadelphia areas by established firm in the zinc and aluminum die casting field. Please send all information concerning territory, experience and other lines carried. Excel Products Company, Codwise Ave. at Elizabeth St., New Brunswick, New Jersey. Phone: CHarter 9-6600.

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LARGER CASTINGS

continued from page 28

It was found that considerable distortion was encountered going into the quench, and the castings are straightened before aging. It found that the castings could not be straightened within tolerance unless they had been within tolerance before heat treating. Now, with extreme care in removing the casting from the mold, rejects from distortion have been reduced to almost zero.

The heavy block design of the molds helps to minimize distortion. Molds for these machines are made from wood patterns, carefully checked throughout. From these patterns, plaster negatives are produced and taken to the Engineered Casting Div. of American Brakeshoe Company where the mold is cast in high alloy iron from the plasters. They are then finished to dimension, giving an exceptionally dense, rigid, nonwarping mold.

• *Torque converter housing* for an automatic transmission, Figure 5a, measures 18" in diameter and weighs 13.6 pounds. Print dimensions call for ±.010 tolerance. This housing is cast in SAE 326 alloy.

This production casting is 100 percent inspected for critical dimensions. Features of this design which required special attention in building the mold and in casting are the heavy bosses occurring in isolated sections around the edge of the rear mounting face. These are subsequently faced, drilled and tapped. Problems of unequal shrinkage had to be solved on this casting.

Another design feature is an opening in the wall of the casting formed by a core that must project from the cover half of the mold, making that portion of the casting have a tendency to stick to the cover half of the mold. This has been overcome by retracting the core about ¼" before opening the mold.

In general, this torque converter housing possesses certain features which make it well suited for permanent mold casting: 1) adequate draft has been provided, 2) wall sections have been well blended from .140 to ¼" to ½" where the thickness is needed for stiffness, and 3) adequate provision has been made for good metal flow.

What can be cast?

Even though the permissible size of castings has been extended considerably by introducing heavy-duty casting machinery and special casting techniques, there are still limits which the designer of such castings should observe.

Probably the largest charge of metal that can be cast successfully with present equipment is about 100 pounds in production quantities.

Size of the casting is, in most cases, limited by the distance between tie bars of the casting equipment. Present limit (based on center distances) is about

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Large Permanent Mold—Cont.

40" wide by 31" deep, while depths up to 20" are feasible.

The exception to the size limit mentioned above is the casting which can be cast in a mold extending laterally beyond the edges of the platen. An example of this is the bowling machine frame mentioned previously, because this casting is 54" in one direction.

Normal draft allowances are 2 degrees minimum inside or out, but selected surfaces can be successfully cast without draft.

Close tolerances are possible across partings and between slides and mold due to the high locking pressure and massive die construction.

Extreme changes in section thickness, though not desirable, can be handled in permanent mold, producing sound sections.

The possibility of obtaining extra large permanent mold castings in aluminum offers the designer a desirable alternative for the sand castings where the size of the casting may have prevented him from turning to a precision type of casting previously.

Sounder, smoother and more accurate than a sand casting, the large permanent mold casting will eliminate much machining, and yet requires only moderate tooling costs. It is essentially a production process useful for medium to long runs of castings, but occasionally permits the economical casting of smaller quantities.

Large permanent mold castings have the same inherent metallurgical quality which favors their use for such special applications as pressure-components, cooking utensils, pistons and load-carriers.

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TOP TO BOTTOM

Continued from page 25

due to porosity opened up in the same castings during machining.

Because of the thinner, more uniform sections, good density, and negligible amount of machined surface area, the die cast pieces have proved to be better in performance, while also lowering costs.

While no actual figures are available for comparison of previous machining with that performed on today's die castings, the fact that only a few cored holes are reamed for draft removal, and certain other minor operations are called for, leads to a reasonable assumption that 75 percent of previous machining has been eliminated.

How does this affect cost of castings? The greater efficiency of die casting, the saving in cost of metal (brass versus zinc) and the reduction in finishing operations, represent a cumulative saving of about 80 percent the previous cost of finished castings. This does not include tool amortization.

MITCHELL-BRADFORD EXPANDS

A new modern plant has been completed by Mitchell-Bradford Chemical Co. at Stratford Conn., according to an announcement from A. J. Mitchell, president of the company. Manufacturing area has been designed for straight-line production flow. Chemical research lab for product control and development is included.

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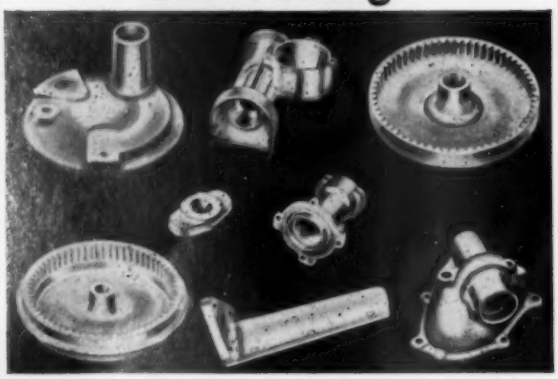

The increased use and acceptance by the public of power mowers has been tremendous . . . in large, this has been due to the choice by their manufacturers of lightweight aluminum and magnesium die cast parts. They help make these rotary and reel-type lawn mowers efficient and attractive, along with the attainment of competitive position in the retail market. Too, the savings in weight effected by these new lightweight alloys have an important bearing on consumer acceptance and save the manufacturer considerable in shipping costs. Greatly important to the manufacturer are the major production cost savings through the minimizing or virtual elimination of machining operations, plus the providing of smooth surfaces and design flexibility. As shown in the photograph, magnesium and aluminum alloy die castings have proved to be ideal for such lawn mower parts as: wheels, gears, gear housings, shaft housings, brackets, spacers, frames, cutter bar supports, etc.

Let's Talk It Over . . .

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PLANT AND EXECUTIVE OFFICES

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ILLINOIS PRECISE LICENSED BY AMPCO

The Illinois Precise Casting Company, 613 West 16 St., Chicago, has been appointed as a licensee foundry according to J. P. Henry, general sales manager of Ampco Metal, Inc., Milwaukee, Wis. Illinois Precise will now produce investment castings from Ampco metal ingot, along with other alloys regularly cast by the lost wax method.

INTERNATIONAL POWDER METALLURGY CONGRESS TO MEET IN AUSTRIA

The Second International Powder Metallurgical Congress will take place in Reutte, Tyrol, Austria, from June 20 to June 23, it has been announced by its sponsor, Dr. Paul Schwarzkopf, president of American Electro Metal Corporation, Yonkers, N. Y. Reutte was chosen again for the seat of this international seminar because Europe's largest powder metallurgical company, The Metallwerk Plansee, owned by Dr. Schwarzkopf, is located there.

The topic will be "High Temperature and Corrosion-Resistant Materials by Powder Metallurgy".

Until now, approximately 300 representatives from 17 nations have been registered as delegates, among them are 36 prominent United States scientists, industrialists and engineers.

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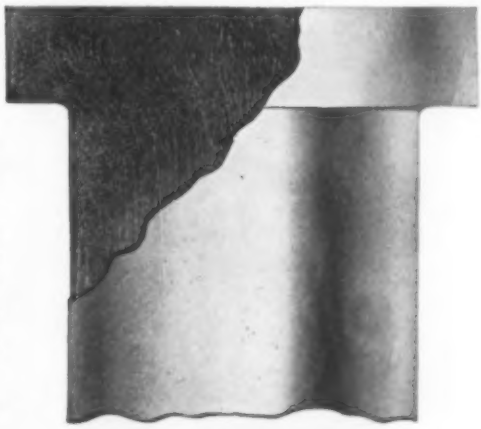

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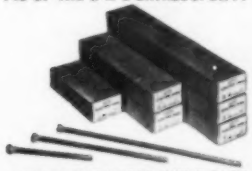

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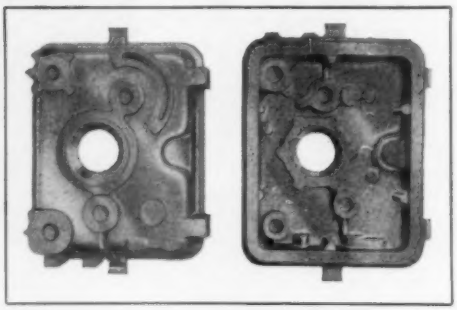

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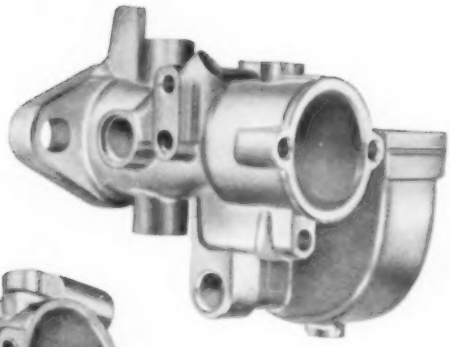
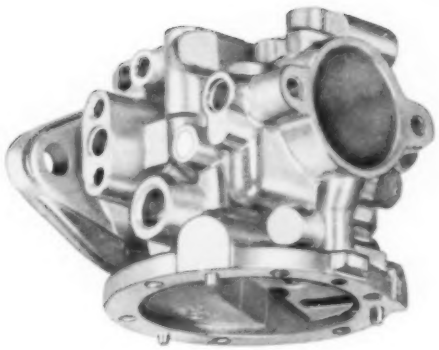
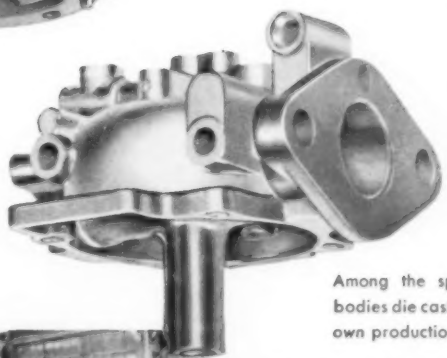






These complex die castings, produced by Hoover for the makers of the famous Tillotson Carburetors, are notable for their intricate coring and many close tolerances. They contain holes on all sides which must be perfectly aligned, and sections of the castings must be free from porosity to prevent leakage.

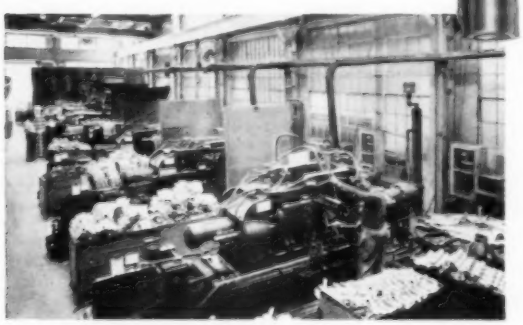
Tillotson Manufacturing Co. writes:

"DIE CASTINGS BY HOOVER

help us make a much better product at a much lower cost"

Among the specific advantages of having their carburetor bodies die cast by Hoover . . . advantages that may apply to your own production problems . . . The Tillotson Company points out:

- **Broader possibilities in engineering design.**
- **Saving in machining time due to large percentage of small holes cored to size and flat surfaces cast smooth.**
- **Saving of number of machines in production line.**
- **Longer tool life, fewer tools required.**
- **Cleaner to handle, less scrap in plant.**
- **Almost complete elimination of rejects.**
- **Smoother, neater appearance and strength with lightweight which have increased our sales tremendously.**



The Hoover Company's complete production facilities for promptly meeting your requirements include 8 zinc die-casting machines, and 27 aluminum die-casting machines carrying ratings up to 400 tons. Castings can be produced from the smallest practical size up to 12" x 12" area and 8 lbs. weight for aluminum and 7" x 10" and 5 lbs. for zinc.

THE HOOVER COMPANY, Die Casting Div., North Canton, Ohio

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HOOVER

Specialists in the fields of die castings since 1922

Write for file folder, "Die Castings." Shows how to step up production and cut costs. Shows their advantages, how they are made, how they should be designed, how they help you step up production and cut costs.

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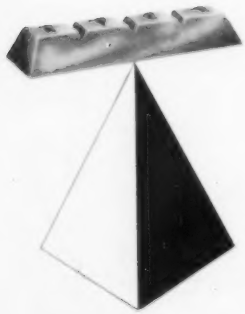

RESEARCH LEADERSHIP BACK OF EVERY INGOT

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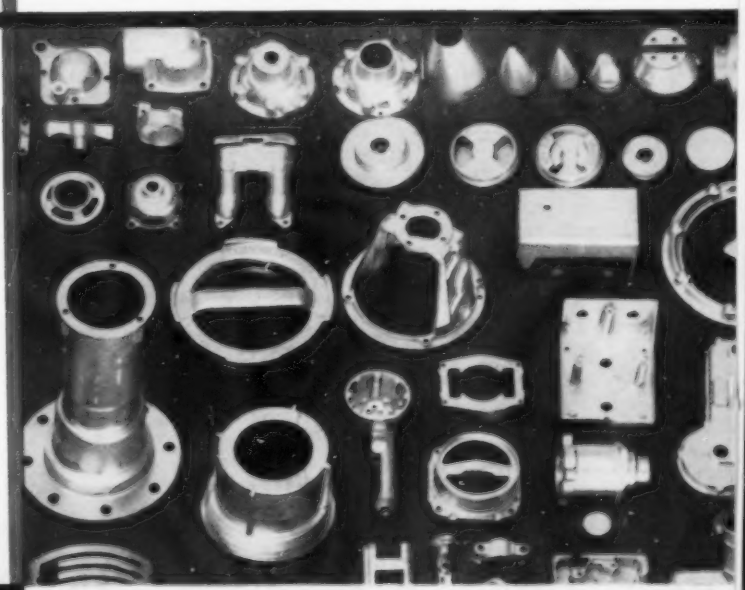

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